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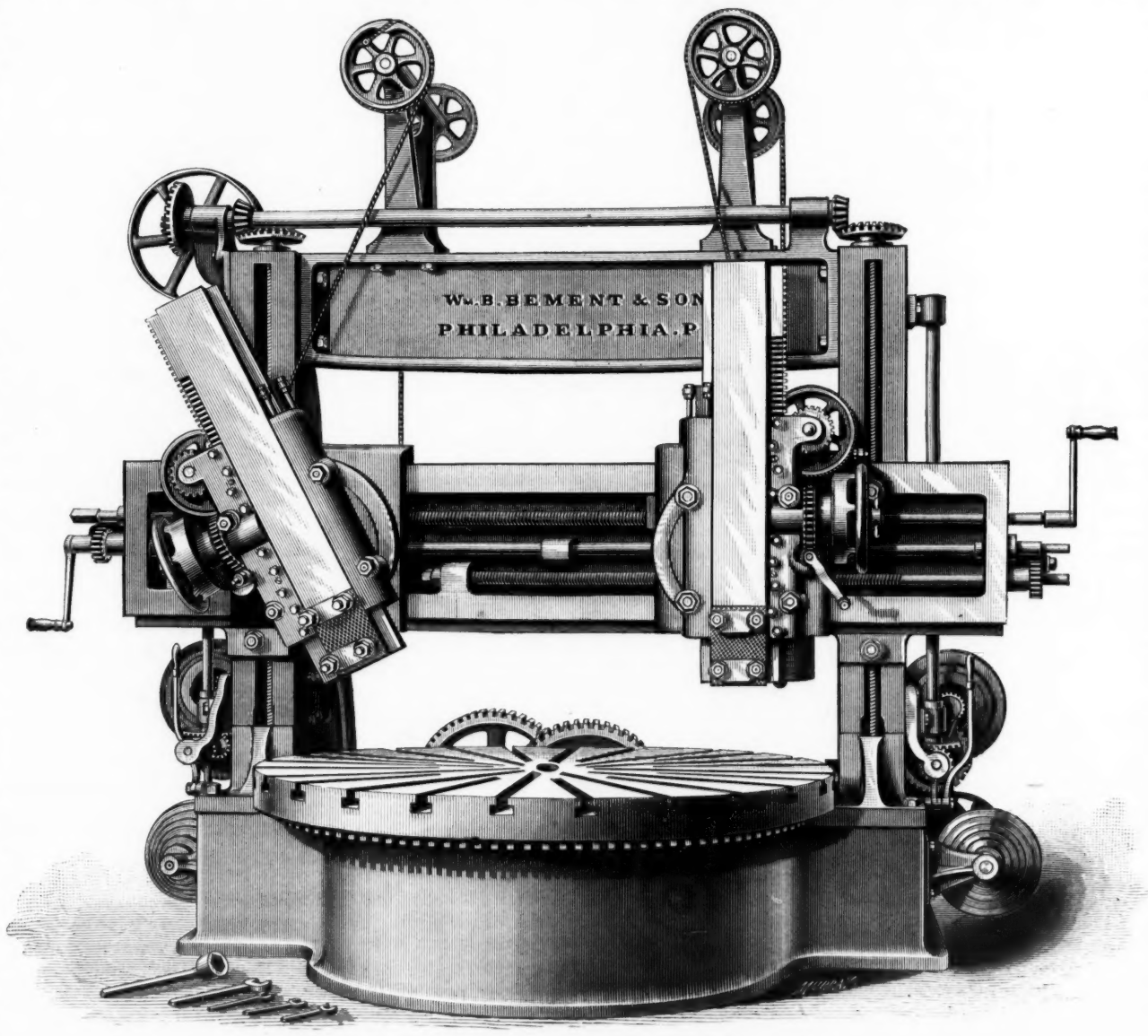
Seven-Foot Vertical Boring and Turning Machine.

We illustrate with this a vertical boring and turning machine, made by William B. Bement & Son, Philadelphia, Pa. It is capable of boring, turning and facing a piece of work seven feet in diameter and four feet high.

The revolving table, or face-plate, is six feet four inches in diameter, and receives motion from a cone and gearing at the back of the machine, having abundant power and range of speeds for work from 2½ inches to 7 feet diameter. The construction is such that all the shaft journals are upon the frame itself, no separate or external support being required.

The bearing on which the table revolves has the form known as the Schiele curve. A curve of large diameter is used, a suitable portion of its largest diameter being applied to give the required vertical support, while another portion of the same curve, taken at a much smaller diameter, is applied centrally to perform the office of a spindle, and give lateral support and steadiness. The relative self-adjustment of the two parts is perfect, and a bearing of this kind, properly arranged and constructed, runs with great freedom and steadiness, requiring no attention beyond oiling.

The cross slide is moved vertically upon the uprights by power, and is of such form as to withstand the strain of the cuts equally well in either direction.



SEVEN-FOOT VERTICAL BORING AND TURNING MACHINE.

The cutter bars are of rectangular section, hollow, and have generous bearing surfaces, with ready means of adjustment. Their construction gives them great stiffness, without excessive weight. They have a vertical traverse of three feet, and are balanced by weights, which are entirely out of the way, and can be separately adjusted to suit the angle at which either may be working, or the greater or less weight of tool which may be in use. The front of each cutter bar is entirely clear, admitting the use of a large square tool or tool-stock of any length.

The variety of feed is ample for all purposes and materials. Each tool has its own complete and independent feed gear, so that either may be moved in any direction and at any rate, without regard to the direction or the rate of the other. The vertical adjustment of either tool may be operated from the end of the cross slide or at the side of the cutter bar, and each has a rapid hand motion by rack and pinion.

Nearly seventeen tons of carefully distributed material makes the machine sufficiently strong and rigid to do heavy work rapidly and accurately.

In looking over the *Patent Office Record* some time ago, we observed a patented method of exterminating wood-chucks and other earth-burrowing animals, and we made a small note of the invention. This has brought us the information that mechanical appliances for exterminating wood-chucks are nothing new. Years ago an old blacksmith in Vermont made a small machine which operated by clockwork to work itself into the farthest recesses of an animal's burrow. The operator was in the habit of attaching a few fire-crackers to this machine, igniting them and starting it on its journey of discovery. It never failed to send out any animals that might be concealed in the hole. A string was used to pull out the machine after it had done its work. Before making the machine for the purpose, the inventor had been in the habit of using a small land turtle, which did the work fairly well. A string was tied to the tail of the crustacean; a few fire-crackers ornamented its body. When it ran in to visit the denizen of the hole, its company was regarded as too tumultuous, and the wood-chuck, badger or other lover of darkness started to visit the upper world, and there fell into the clutches of attentive terriers.

Proposal to Operate the Elevated Railroads by Electricity.

Cyrus W. Field is vice-president of the Elevated Railroad Company, of New York, and he is generally regarded as the right-hand man of Jay Gould in all the industrious operations needed to keep up the reputation of the stock of the elevated railroads. Cyrus W. Field does not include the profession of mechanical or electrical engineering among his personal accomplishments, although he is reputed to have considerable experience in the engineering of stocks; but at a recent meeting of the company, of which he is vice-president, he undertook to give the world a lecture on the most economical motive power for operating elevated railroads. Mr. Field intimated that he has the authority of Sir William Thomson for saying that nothing could be better fitted for the application of electricity as a motive power than an iron track raised in the air. The use of electricity in place of steam would, it is estimated, says Mr. Field, effect a very great reduction in the expense of operating our roads; while the removal of the heavy engines, making the passage of the trains almost noiseless, would bring this system of rapid transit as near perfection as we are likely to attain in our day.

Although Mr. Field is no engineer, he knows as well as any man in this country that no means of transmitting motive power through electricity has yet been so far perfected as to compete economically with locomotives even on elevated railroads. The assertion that trains could be run noiselessly, were the heavy locomotive taken away, is a deliberate deception; and the whole of Mr. Field's talk about reducing operating expenses by the means indicated has apparently nothing more behind it than a disreputable attempt to bull the stock of the road.

During the first few months the New York, West Shore and Buffalo Railway was in operation, the public were very indulgent towards the flaws of management that permitted frequent collisions of trains. It was then understood that the greater part of the train men were strange to the road, and it took time and labor to drill them into their duties, and familiarize them with rules that in many instances were different from what they had been accustomed to. But the road has now been in operation over a year, and it is time that the working of trains should be carried on without collisions. Yet that kind of accident continues to be alarmingly frequent. One of these most unjustfiable occurrences, of one train stopping on the main line and another running into it, happened last week. An impression went abroad the time the West Shore route was opened that the road was equipped with a block system of signals. The frequent accidents serve, in a striking way, to notify the traveling public that the block system protects merely a small portion of the road.

It is claimed, from some experiments made in England with steam engine valves of the Corliss type, that by compelling slight endlong motion a great advantage in the wear of the surfaces is gained. The plan is not new, but if properly carried out ought, in some degree, to prevent scoring of valves and seats. The endlong motion, however, should be irregular in extent and time.

Correction.

In the article on "Train Resistance," by Angus Sinclair, in our issue No. 47, page 1, of this year, a mistake was made in the figures. In the last paragraph of the article, the total foot-pounds should read 86,400,000, and the traction should read 16363.

Safety Valve Problems.

The problems involved in the operation of the ordinary weighted safety valve are simple, but, from a good many inquiries we receive, the subject is evidently not always so well understood as it should be by those in charge of boilers. In answer to several requests, by the aid of the sketch the matter is made plain enough for any one acquainted with the simple rules of arithmetic to understand.

The questions that are likely to arise are: What should be the position on the lever of ball *A*, of a given weight, that the valve may begin to blow at a given boiler pressure? What should be the weight of ball in a given position on the lever that the valve may blow at a given pressure? At what pressure will a valve blow with a ball of a given weight in a given position on the lever? The position of the ball *A* is in all cases measured from the fulcrum, at *a*.

The force with which the valve *V* will tend to leave its seat is found by multiplying the pressure per square inch—the gauge pressure—by the area in square inches of that part of the valve that is exposed to that pressure. The area of valve is found by multiplying the diameter by the diameter (squaring the diameter), and multiplying the product by the decimal .7854. Let the diameter *d d'* be 3″, and the boiler pressure 80 lbs. Then $3 \times 3 = 9$ and $9 \times .7854 = 7.06$ inches, the area, omitting decimals beyond two places. The valve will tend to leave its seat with a force of $80 \times 7.06 = 564.8$ lbs.

Suppose the ball *A* to be removed, the valve will be held down, first by its own weight, and, second, by the weight of the lever, the effect of which is increased by its center of gravity being somewhere to the right of the center of the valve at *b*. The valve can be weighed, and the easiest way to find the downward thrust of the lever is by weighing it. This can be done by attaching a spring balance to the lever, just as it stands, directly over *b*, and noting how many pounds' pull is required to just lift it. This, added to the weight of the valve, will be the pressure holding the valve to its seat. Manifestly, if the valve is attached to the lever, both can be weighed together. Say, the weight of valve and of the lever, as described, is 40 lbs.; subtract this from 564.8 lbs., and the remainder must by held by the ball; 564 8 — 40 = 524 8 lbs. to be held by the ball.

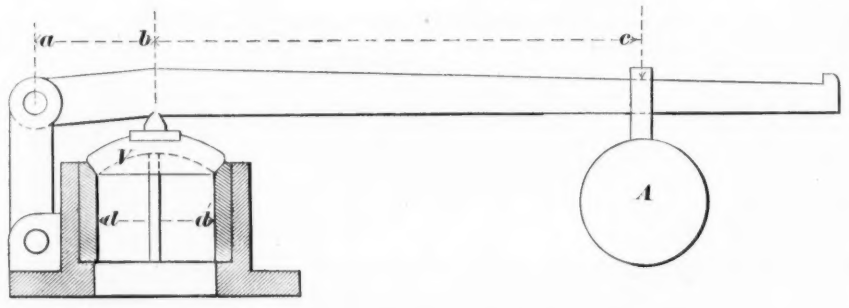
Say, the ball weighs 95 lbs., and the distance *a b*, from the fulcrum to the center of valve, is 4″, what must be the position of the weight on the lever (the distance *a c*), to just hold this 524.8 lbs.? To find this, multiply the pounds to be held by the distance from *a* to *b*, and divide the product by the weight of the ball. $524\ 8 \times 4 = 2099.2$, and $2099.2 \div 95 = 22.09$″, slightly more than 22″ from *a* to *c*.

It is required to find the weight of a ball on this same lever, the ball to be at a distance from *a* to *c* of 28″—valve to blow, as before, at 80 lbs. To do this, multiply the pounds to be held by the ball, by the distance from *a* to *b*, and divide the product by the distance from *a* to *c*. Thus, $524.8 \times 4 = 2099.2$, and $2099.2 \div 28 = 74\ 97$ lbs., a trifle less than 75 lbs. for the weight of ball.

If the ball weighs 100 lbs., and is placed on the lever at a distance of 20″ from *a* (*a* to *c* = 20″), at what pressure will the valve begin to blow? To determine this, multiply the weight of ball by the distance from *a* to *c*, and divide the product by the distance from *a* to *b*; this will give the downward thrust on the valve due to the ball; $100 \times 20 = 2000$; $2000 \div 4 = 500$ lbs. force exerted on the valve by the ball. To this must be added the force due to the valve and lever; 500 + 40 = 540 lbs. downward pressure on the valve. Altogether, the area of the valve is 7.06 inches, and $540 \div 7.06 = 76.4$—not quite 75 lbs. per square inch—which will be the pressure at which the valve will blow.

John Augustus Durgin.

The life of Mr. J. A. Durgin, whose untimely death we recorded last week, supplies another example of an American mechanic, by his own unaided exertion, raising himself from the grade of ordinary workman to a prominent professional and social position. About thirty years ago John A. Durgin began his mechanical career by starting work as fireman on the old Boston, Hartford and Erie Railroad, which is now part of the New York and New England Railroad. For some time he fired for Mr. H. A. Little, now agent in New York for the French Spring Company, who was then an engineer on that road. Some trouble arose in the management of the road, which was in a harassed condition financially, and operating was entirely suspended. Among others thus thrown idle was Durgin, then a youth, and he went to Taunton, Mass., and got work in the Mason Locomotive Works. Here he remained and learned the machinist trade. While working through his apprenticeship, he devoted his evenings to learning drawing and studying the principles of mechanical science, and by this means prepared himself for a position in the drawing office, which he secured in due course.



After a few more years spent in the Mason Works, Mr. Durgin obtained the position of master mechanic of the Portland Locomotive Works, under Mr. John Sparrow, who was then superintendent. From here he went to be superintendent of the Lancaster Locomotive Works, in Pennsylvania, and there he remained till, crushed by hard times, the concern collapsed. His career as superintendent of the Pittsburgh Locomotive Works, then of the Rhode Island Locomotive Works, is well known, and his energetic labors did much to bring the locomotives of both these works into prominence. A year ago, last June, he left the Rhode Island Locomotive Works, and went to Europe, where he remained over a year, devoting close attention to the details of locomotive building, as practiced in the best shops abroad. Immediately after returning to America, he was engaged as manager of the New York Locomotive Works, but the position did not suit him, and he accepted the post of superintendent of motive power of the New York, Providence and Boston Railway, the duties of which office he was just entering upon when he met with the accident which resulted in his death. As a mechanic, Mr. Durgin was noted more for getting out work quickly than for accuracy, but he recognized fully the advantage of introducing the interchangeable system into locomotive work, and freely gave a helping hand in establishing that system. While an excellent executive officer, the great forte of Mr. Durgin was in pushing sales. He was a ready free-hand sketcher, and used the graphical method with good effect in convincing a customer as to the superiority of the locomotives he made. He had a decided individuality, and he put his impress upon the American locomotive engine so deeply that his name will not be soon forgotten.

We recently saw some hardwood—beach—boxes that had been in use under a shaft, running 150 revolutions, for fifteen years.

Notes of the Society of Mechanical Engineers' Meeting.

The reading by Mr. West, of his paper on "Sound Casting," elicited considerable discussion. (See paper on page 6.)

Mr. Barnes was gratified to hear, and he thought all those who use castings would be equally pleased to know, that a systematic effort was being made to produce good castings, and to find out the reason why castings do not come out of uniform quality.

A member could not understand why castings made under precisely the same conditions often turned out so differently. He mentioned a case where two driving wheels were poured in the same heat, and one shrank much more than the other.

Mr. Stetson used to think that no one knew anything about castings except the machinist who turned them, and he was gratified to think that moulders were studying the subject. He wanted to know if any progress was being made in moulding under pressure.

Mr. Stratton explained, for the benefit of the last speaker, that a recent report of the Naval Ordnance Board contained interesting particulars of casting steel guns under pneumatic pressure in Europe.

Mr. Barr had experienced difficulty in finding the kind of pig iron most suitable for certain castings. In searching for light on this subject, he had had pig iron analyzed, yet even then the result was very unsatisfactory. It appeared that men accustomed to select pig could come at an approximation to wha was wanted from the fracture as nearly as could be done by analysis, yet the former plan was far from being accurate. Speaking of the round balls shown by Mr. West, he was surprised, when in the Government service, to find how accurately round cannon balls were cast. He wanted to know how it was done, and if selection of iron had anything to do with the good results obtained.

Mr. Stratton believed that many castings are spoilt through a mixture of Scotch iron being used. Most of Scotch brands have a tendency to cause blow-holes, yet moulders will persist in calling for its use. He believed that properly-selected American iron produces the best kind of castings, with least trouble in the working.

Mr. Durfee asserted that in many cases the man who daubs up the cupola exerts great influence for good or evil on the product. He mentioned a case where he sold pig iron to a foundry, and complaint was made that the product was very bad. As he knew the iron was all right, he investigated the matter, and found that a miserable old cupola was used, with the tuyeres turned upward, so that when the blast was applied it acted like a reverberatory furnace, and changed the character of the iron. Turning the tuyeres down ended the trouble.

The paper read by Mr. F. A. Halsey on "A New Rock Drill," and that by Mr. T. Bergner on "Recent Improvements on Drawing Boards," created no discussion of any moment.

The two papers, "Measurement of Friction of Lubricating Oils" and "On the Sliding Friction of Rotation," respectively by Mr. C. J. H. Woodbury and Prof. Thurston, were discussed conjointly.

Prof. Thurston asserted that by increasing the diameter of a journal you do not decrease its tendency to heat under a given load. The old laws published regarding friction are found to be all wrong when applied to lubricated surfaces. The coefficient of friction is greatly different according to the way the lubricant is applied, as well as the quality used. Tower's method of flooding the moving surfaces gives a much lower coefficient of friction than the ordinary drop methods supplying oil. He had a case in his own experience that demonstrated the difference. A friend of his in the West wrote saying that he got a much lower coefficient of friction with the oil used than the figures given by himself. After making inquiries, Professor Thurston found that this gentleman kept the journal flooded, which accounted for the superior results obtained.

Mr. Towne gave some particulars of the experiments on lubricants conducted in Britain by Mr. B. Tower, wherein were plainly demonstrated the advantage of keeping the rubbing surfaces submerged in a bath of oil.

Dr. Irvine, analyst for the Standard Oil Company, was requested to give his views on the subject of lubrication, and he complied in an interesting speech. In the practical application of lubricants he discovered many curious phenomena, which physical science had yet been powerless to explain. For instance, an engineer has been using the same brand of oil right along, and one day he comes with the complaint that a particular barrel of oil is not giving satisfaction. His bearings had run quite cool till this barrel was drawn upon, but now they are all running hot. We take this oil and analyze it. It has precisely the same characteristics as the oil that was previously used. Its viscosity, fire test, specific gravity, are the same, and this test would lead us to the conclusion that it must give the same result as a lubricant; but, when we subjected it to a comparative test with the other oil in a journal box, we find the complaint true that it permits the bearing to run hot. Oils show many other peculiarities. It is generally supposed that products of petroleum can be prepared that will supply lubrication to any kind of bearing, but that is not so. For hard bearings a mixture of animal oils is requisite. He did not think the experiments—such as were described by the papers under discussion—were of much value for showing what kinds of lubricants were best adapted for practical purposes.

Mr. E. F. C. Davis, superintendent of the Philadelphia and Reading Coal and Iron Company, showed by means of a magic lantern a great many photographic views of the interior of the anthracite coal mines taken by aid of electric lights. The views were taken owing to a request that the company should show something at the New Orleans International Exhibition to illustrate coal-mining operations. They are exceedingly interesting and very striking. They show with vivid distinctness the appearance of the coal workings, the operations of the miners, and the geological formation of the coal beds.

To produce the light necessary for taking the photographs an electric light plant had to be taken down into the mines. Arnoux dynamos were used for producing arc lights. They were driven by a 9x12-inch horizontal engine, run by compressed air, a supply of which was led through the mine for ordinary work. The engine, dynamos and the timbers used for foundation were all taken from a railroad car, down the mine, and erected in running order within six hours. Several peculiarities were observed in running this electric plant at the bottom of a deep mine. From indicator cards taken at another mine, Mr. Davis arrived at the conclusion that, while on the surface an arc light consumes .875 horse-power, in the mine the same light requires 1.26 horse-power to keep it going, an increase of 44 per cent. The loss he attributed to the damp surroundings of the mine, which produced increased dissipation of electricity. Yet, strange to say, it was not found necessary to run the dynamos at a higher rate of speed than was required on the surface. The photographs were taken by Mr. George M. Beety, and the plates had generally to be exposed about half an hour before a good picture was taken. The work was very skillfully done.

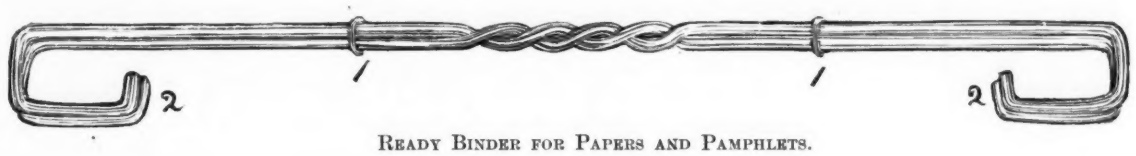
The remainder of the papers were read by

short abstracts, or by title alone, and elicited no discussion.

After passing the usual resolutions of thanks to the retiring officers, and to those who had extended courtesies to the Society, the meeting closed.

The Ready Binder for Papers and Pamphlets.

This little device is very clearly shown in the engraving. To use it the clasps 1 are slid in towards the center, and the papers, pamphlets, or whatever are to be held, are



READY BINDER FOR PAPERS AND PAMPHLETS.

inserted between the wires at 2. Then, by moving the clasps towards the ends they are firmly secured. It is a very neat arrangement for holding newspapers, periodicals, sheet music, writing paper, bill-heads, or, in fact, loose sheets of any kind. It is made by R. E. Bean & Co., Franklin Falls, N. H.

The Machinery Purchase-Hire Company.

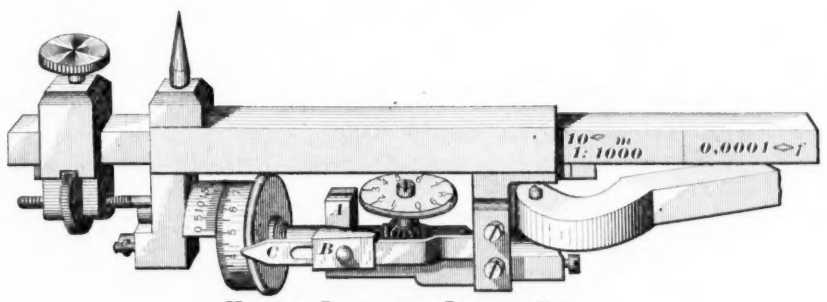
A company under the above name has been established at 147 Queen Victoria Street, London. The object of the company is to assist in the obtainment of machinery on deferred payments. It may frequently occur that a machine or tool maker has a machine to sell for which it is inconvenient to receive other than immediate payment. Probably the one man who requires the machine, and who could with the work he has for it to do easily make it pay for itself in a few months, cannot see his way clear to pay down the price on the spot. Such a case is a legitimate field for the operations of the new company, who will find the money to pay the machine maker, and hire out the machine to the user under due security, the user paying a rental for the use of the machine, which becomes his own in a certain specified time. A man of small means is thus enabled to pay for his plant out of revenue instead of capital, and as the revenue is earned by the plant this is reasonable. The terms offered are not onerous, and we should fancy that the scheme will work successfully.—*Mechanical World.*

Halpin's Planimeter Locking Gear.

We take the following from the London *Engineer:*

"The annexed engraving shows a simple form of locking gear which has lately been devised for Amsler's planimeter, and which is now being introduced by Messrs. Elliott Brothers, of 449 Strand, London. The locking gear consists of a spring *C*, one end of which is T-headed, and which is fastened to the instrument by the screws already there for another purpose, and of a wedge-piece *B*, sliding on this spring. As this wedge-piece *B*, is made to travel backwards and forwards on the spring by means of the button fixed on to it, it bears on the back piece *A*, and so causes the nose of the spring to rest on the edge of the wheel which traverses on the paper. When this takes place, of course the traveling wheel is no longer able to revolve.

"The advantages claimed for this locking gear are that the instrument can be read with much greater facility, and that the decimal places, which are omitted when the instrument is used in the ordinary way, are carried over, as the instrument now—as will be presently described—does its own addition. In using the instrument it can be taken to the light and set at zero, and locked; it is then placed in position on the paper, ready to take the diagram, and unlocked, run over the diagram, and locked again, when it can be taken up from the paper without fear of losing its correct registration, and read conveniently in any suitable light. One of the chief uses, however, which mechanical engineers make of the planimeter are to calculate the mean pressures on an area of engine diagrams, particularly on trials, when, of course, very large numbers of diagrams are taken, and have each to be calculated. When this has to be done the instrument is, as before, set at zero and locked; the first diagram is then put under it, the locking gear opened, the diagram run over, the instrument is locked, and the diagram taken out, and the second diagram is put in place, the instrument unlocked, the diagram run over, and the process repeated as before. In this way ten diagrams are taken, and the decimal point at the last reading is put back one place; by this means it will be seen the liability of clerical errors arising in the addition is greatly lessened, and the otherwise unknown value of the last decimal place is carried forward."



HALPIN'S PLANIMETER LOCKING GEAR.

Then and Now.

BY JAMES F. HOBART.

The mechanical writer of to-day is not what he was years ago. Look over the files of any old journal and read the mechanical sketches. About all of them are elaborate productions, compiled from text-books or manufactnrers' circulars. They were about as useful to the shop hand as the dictionary was to the old lady who had "tried to read it lots of times, but couldn't get the hang of the story." There was a good reason for a scarcity of useful mechanical reading. There was no demand for it.

Bob and Tom didn't want it. They were in the shop to learn how the boss did work, not to pick up a new way of doing things. Then, a boy learned a trade. He served his time, stumbled along as best he could, and mastered all the "trade secrets" of the day. Then, a person engaged in a certain trade or manufacture monopolized the patronage in his vicinity. There was hardly any competition. He had things his own way, and did work just as he pleased. He made money at it, too. Other parties were not so ready to jump into that business just as soon as a dollar was to be made at it.

Now, things are changed. A man in business can't get along with his own experience. His "trade secrets" don't keep him up with the times. He wants the benefit of everybody's experience; and he is bound to have it, too. Naturally, in looking for information, he got willing to tell what he knew himself, and so the "closest mechanical writer" had to go. No use, now, to hunt in the back office for notes for a sketch in a mechanical paper. Let out that job to the mechanic himself. This is what makes our mechanical papers indispensable. We have got to have the benefit of everybody's blunders and successes, and are willing to swap our own for them. Perhaps our blunders may be of more value to you than were our successes. It is of as much value to know what not to do, as what to do, or a new way of doing something. Now, if our writers will do one thing better, they will improve what we need the most. Give the details when telling how you did a job. Don't tell what you wanted to do, and then jump right to the result, but give the details. Give them all. No matter if they seem insignificant to you, they may be of value to us. Many a time we have been disappointed when trying to perform an operation as described by a writer, and failed through the lack of some little detail which he did not think of value enough to write about, or which escaped his attention entirely.

Another point will apply to many writers. Give the way you do little things about the shop. The ones you do a thousand times a week, and never think how or why you do them thus, are the ones we want to hear about. We don't care half as much about that elaborate theory of link motion and valve travel which you have figured out, as we do about the way you grind a tool to make it take a big, easy, smooth cut, or how you get the "kink" out of a shaft that "sprung" while being turned. Give us some of the makeshifts you use in the foundry; tell how you learned to put nails and "gaggers" in refractory moulds that wouldn't "cope." We want to know how you gate some of the odd shapes that happen along every day. The best place for risers, where to take off the gas, etc. Of course everybody knows how to do these things, but everybody don't know your way, or do them as you do. Perhaps your way is the best. If it is, we want it. Tell us of it, and you may hear of a still better way.

The big shops don't need the makeshifts we used to practice in the little country concern. If they want to bore a taper they don't have to rig up for it and then do it by hand to the tune of "Old Grimes." Or if a big job, with a heavy cut, run through it to "Old Hundred." This looks like the "rule of thumb," but the truth of tapers that have been bored in this way would surprise you.

One day I had to bore out an old plug valve and fit to it a new plug. I had a screw-cutting lathe to do the job on. The lathe was built fifty years ago, by the proprietor when a boy. That taper hole was three inches long and tapered one-half inch. I bolted the valve to the face-plate, as we had no chuck large enough to carry it. The cross-feed screw was twelve pitch. There was a little hand wheel on the end of it, divided by spokes into four parts. I set the change gears to cut forty-eight threads, and with a piece of chalk divided each quarter of the hand wheel into twelve parts. Setting the tool at bottom of the hole, I hunted up a tune to fit the speed of the lathe.

The valve being brass, a lively tune was in order. Finding that Yankee Doodle was about right, as it went as fast as the spindle did, I began to whistle it and feed out the tool, turning the hand wheel one mark to each beat. After running through twice, I put the plug in the lathe and served it the same. When they were done, it took but very little emery to make them fit. It won't do for the tobacco chewers to try this game. They will stop whistling to spit on the lathe leg, and out they go. Perhaps they might hire a hand organ and get along.

One more point is in order. When writing how you do a certain job, the value of your article would be increased by a cut illustrating your point. Not one mechanic out of a hundred but can sketch it out on the floor with a piece of chalk. Take a pen and India ink, draw it on a piece of plain white paper, and send along with your article. It costs but a little effort and adds much to the value of the article.

Importance of Establishing Tin Plate Manufacture in this Country.

In our last week's issue we published a circular issued by the American Tinned Plate Association in regard to the importance of establishing tin plate manufacturing in this country. We addressed a letter to John Jarrett, general agent of the company, inquiring what duty they consider desirable to protect the manufacture in the United States. Mr. Jarrett writes us as follows:

"We welcome your proffered aid in the furtherance of the objects of this association, viz: the establishment of the tin plate industry in this country. The rates of duty we are endeavoring to have placed on tin plates is 2½ cents per pound. The maximum rate on galvanized iron, that is on all gauges between 25 and 30 at the present is 2¼ cents per pound. The minimum of duty on tin plates should be no lower for the reason that tin plates run very much lighter in gauges than galvanized iron. Another feature is that the crosses while heavier in gauge than I C, are higher in price, while the price of galvanized iron increases in price as the gauges run lighter. Galvanized iron is sold by the gauge; tin plates are sold by the box. Under these considerations a rate of 2½ cts. per pound duty on tin plates would be safe and perfectly satisfactory, and one under which their manufacture would be amply protected, and without question one under which the industry would be successfully established in this country.

"The importance of the industry is easily comprehended if we but compare it with that of steel rails, and railroad construction from 1870 to 1883. In 1870 we produced of steel rails in this country 620,000 net tons; in 1883 we produced 1,360,694 net tons, an increase of 119 per cent. At the close of 1870 we had 58,984 miles of railroad in operation; at the close of 1883 we had 127,925 miles of railroad in operation, an increase of 117 per cent. The amount of tin plates imported in 1870 was 75,467 net tons, while in 1883 we imported over 24,000,000 net tons, an increase of 218 per cent. You will see by a glance at these figures, that this industry is actually as important, if not destined to be more so, than that of steel rails.

"You will observe by the circular the amount of wages paid in tin-plate works was $12,000,000. In Great Britain the wages for same class of labor is but a little over $5,000,000.

"Very truly yours,

"JOHN JARRETT, G. A."

If we are to accept the statement of an Indianapolis paper, one of our prominent Western railroads is carrying the practice of would-be economy in the mechanical department to an inconvenient extent. The paper in question says:

"Superintendent Whitcomb reports that the Bee line people have hired one of the Belt road engines to help them out in their switching service. This is one of the results of running shops on the cheap, as the Brightwood shops are now run. The Bee line a year ago had six first-class switching engines; but two of them are now fit for service—the other four are in the shops."

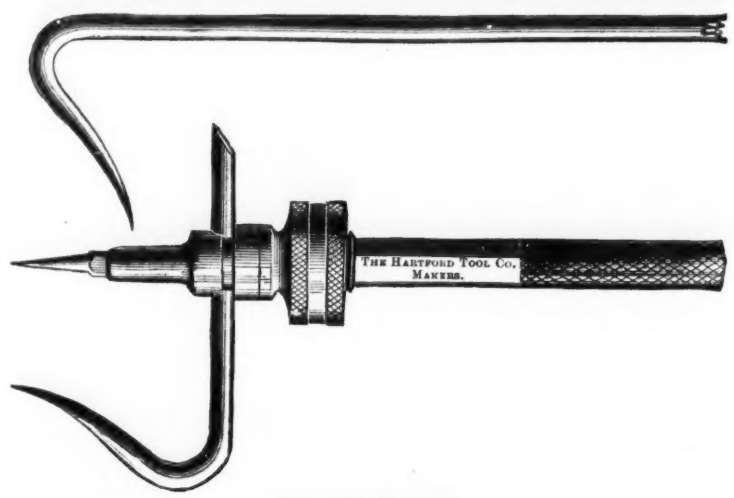
It should perhaps have been stated in connection with the indicator diagrams from a Westinghouse engine, published last week, that they were from a farm engine built by the Westinghouse Company at Schenectady, and not from a Pittsburgh engine. The back pressure shown is accounted for by the contracted exhaust to produce draft.

Any depression there may be in the general business of the country does not, apparantly, extend to the business of the Patent Office. Inventors seem to be getting ready for better times by inventing new devices in abundance, and manufacturers are evidently contemplating improvements as much as ever.

Improved Divider.

The little tool illustrated herewith is made for describing circles of any diameter, taking the place of ordinary dividers. By its use the crowding over of the center is avoided, as no matter what the diameter of circle, the pivot point and the describing point both stand perpendicular to the work. The tool can also be used for cutting out circular disks in soft metal. It is made of tool steel, the points being carefully hardened. When desired, a lead pencil holder is furnished.

The manufacturers are the Hartford Tool Company, Hartford, Conn.



IMPROVED DIVIDER.

LETTERS FROM PRACTICAL MEN.

Machine Shop Floor.

Editor American Machinist:

I notice in your issue of Nov. 8, a description of the floor of the crane shop of the Yale & Towne Manufacturing Company. Having been in charge of the erection of that building, perhaps my experience in the laying of the floor may be of value to some of your readers. The floor was laid on a bed of puddled gravel, which was so hard that with the use of a bar it was impossible to drive the stakes more than 12″ deep without splitting them, and then the gravel was so loosened around them as to afford but little side support. They were also twisted and thrown out of plumb by the gravel stones; consequently it was very difficult to nail the strips to the stakes, and at the same time keep them level and in line. The nailing strips were 2½″x4″, and were too light to allow of secure nailing to the stakes. Many of the latter were loosened by nailing. The concrete was with difficulty packed under the strips. The lower layers being of somewhat coarse cobbles, would not pack firmly in a depth of 4″. They also pushed through when jammed under, on account of the slight width of the strips. In consequence of this bad packing some of the strips were driven down a little when the 2″ spruce floor was nailed, which, of course, caused a hollow place in the floor. We succeeded, by a great deal of care, in getting a substantial floor. I think, however, that a floor made as follows would be more substantial and less expensive to lay, especially when there is as good a bed as we had, and probably it would be perfectly good on any well-packed bottom:

On the prepared bottom lay and ram hard 4″ of concrete (cobbles from ½″ to 2″ diameter). On this lay rows of fine concrete 8″ wide and 30″ apart, of sufficient thickness to ram down and level so the tops will be 5″ above the bed, giving 1″ thick of fine concrete. Lay on these leveled rows nailing strips 3″x 6″, on their flats. This will give them good, uniform bearings 6″ wide. Across the tops of these strips nail long battens to keep them in place, and fill up between with concrete. Ram very hard and make flush with the tops of the nailing strips, or round it a very little between them. After mopping the tops of the strips with hot coal tar it is ready for the planking.

M. W. SEWALL.

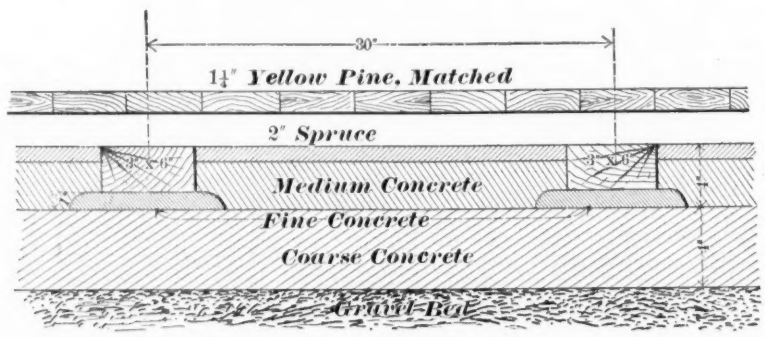
To Disconnect a Locomotive with Broken Valve Yoke.

Editor American Machinist:

"S. A. A." thinks "L. S. S." ran a great risk in not taking off steam-chest lid. He says, if the stem had been broken off inside the steam chest, instead of the yoke, it is most likely that the stem would have blown out, and the valve would then be at liberty. I would ask "S. A. A." if he ever knew of a valve stem blowing out when it was only broken once?

I think to blow out a piece of the stem it would have to be broken twice. Allowing "S. A. A." to blow out a piece of the stem, I would ask him if he could find no way to shove the valve ahead and secure it without taking off steam-chest lid? He says the valve would be at liberty. I would say, the valve would only be at liberty while the train was stopping, and "S. A. A." must admit that it could not do any harm in that time. He says, again, if the whole of the front of the yoke should break off (on some engines) the valve could have moved ahead far enough to leave exhaust port open. That may be so, but I never saw one. He says, better take the safe course and run no risk. Very true. I see no risk when the crosshead is properly blocked, even if steam were admitted into the forward end of cylinder. I consider it more risk to block main lines on railways—the extra time it takes to do the work—as serious accidents happen sometimes from short delays. He says, again, all is well that ends well—as much as to say, practical knowledge is of no use. I will say, in conclusion, that every engineer has, or should have, a thorough knowledge of valves and their travel. To get the travel correct, I cite to him AMERICAN MACHINIST of May 24, 1884, and a little practical knowledge will make him correct. The practical knowledge should be got by going in the shop with his locomotive when she is being repaired.

S.



How to Clean Foul Pipes.

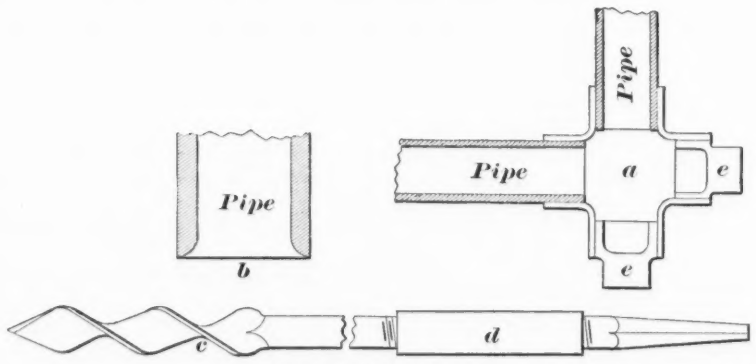
Editor American Machinist:

The chief objection to wrought-iron pipe as a water conductor is its liability to rust and to clog with sediment. Cast-iron is less objectionable in this respect, but its friable nature renders it unsuitable for pipes of much less than two inches in diameter. Lead, copper, tin and brass pipes are too costly for general use; hence, for water conductors of small size, iron pipe must continue to be chiefly used.

I would suggest to those who are much troubled with foul pipes to have their plumber remove the "elbows" or "quarter bends" at the angle joints, and substitute crosses, as shown at *a* in the sectional sketch, and at the same time have the plumber burr off the inner corners of the pipes, as shown at *b*. Then, whenever the pipes get foul, the plugs *e* may be unscrewed, and a bit (somewhat of the style shown at *c*) inserted, and the obstruction quickly dislodged. The bit may be run in any distance desired to the next angle by using extension rods of different length, and a few screw couplings *d* made of gas pipe. The bit should be made of steel, well tempered and sharp, as the obstruction is often quite tenacious. It would be a great convenience if all pipe manufacturers would work exactly to standard gauge as to the diameter and caliber of their pipe.

I think it questionable whether coating iron pipe with zinc is of any benefit. It seems to institute a chemical contest between the two metals, in which the iron gets the worst of it, especially if the water is impure or the pipe is located in a damp place.

F. G. WOODWARD.



CLEANING FOUL PIPES.

Mixing Iron.

Editor American Machinist:

A good deal has been written on melting iron. Would a few notes of mixing iron for strength be of service? It is an important matter to those making agricultural implements and piano plates.

I find the strongest iron can be made by mixing No. 1 Ohio, American Scotch, and No. 1 Lake Superior, Appleton (the Scotch is the Rockwood brand), and good machinery scrap, in equal parts. I have taken tests from this iron, and by making test pieces two feet long and 1¼″ square it will give a test of 1,700 pounds.

When I was foreman for B. F. Sturtevant, of Boston, I tried a great many brands of iron for strength, and mixed a good many brands. The best test I ever got was 1,846 lbs. from a mixture of equal parts of South Easton, No. 2 Crane and No. 1 Eglington Scotch imported.

In a great many foundries very little attention is paid to the melting of iron or the brands of iron that are used. I take a test from my heats about once a month, and find just how my iron is running.

There is a good deal of imported Scotch iron used in the East. It is good to soften scrap where strength is not required. Rockwood and Appleton, half-and-half, make a splendid, soft, tough iron for pulleys, or for any casting that has to be turned.

DAVID SPENCE,
Foreman G. W. Brown's Foundry,
Galesburg, Ill.

Carelessness and Ignorance in Handling Steam Plants.

Editor American Machinist:

I was sent for at one time to caulk the flues of a horizontal boiler. On examining the flues, the upper row presented a burned appearance, showing that they had been hot a great many times without being covered with water. Mentioning this to the man in charge, he remarked: "Oh, I don't use that row of tubes. I can make steam enough without them." That man was employed by a stock company to run a small factory, and had entire charge of the machinery.

Another time I stepped into a mill, and noticed that the escaping steam had a blue, gaseous look. The boiler was found to be quite dry, with a roaring fire of pine knots in the furnace.

In another case, coming to my notice last week, the check valve between the boiler and feed pump became fast, so it could not seat. The pressure from the boiler blew out the plugs, and the contents of the boiler took possession of the boiler room. The cock between check and boiler had stood so long without being moved that the engineer could not turn it with a wrench.

Corning, Iowa. J. T. SMITH.

Information Wanted About Economy in Melting.

Editor American Machinist:

I have been very much interested in your articles on melting, and wish you would give us "little fellows" (in the moulding line) a little chance for information. I am like a lot of other small melters, in want of information in regard to melting in our small way. It takes 300 to 350 lbs. of coal to make a melt of 1200 to 1400 lbs. of old iron—stove-plate metal. Am I using more coal than I ought to use? I make plows, box-stoves and other things, the same as any small country machine shop and foundry. My cupola is about 25 inches inside at melting point; have two tuyeres about 2½″×4″, and carry my wind about 100 feet in a wooden box 6″ square inside; have a fan 24″ (home-made) with 6″ blades; it runs about 2200 revolutions. Please give us what would be a good fair thing to do with such iron in such a cupula.

JOHN W. MARKLAND.
Barton, Vt.

Planing and Turning Irregular Shapes.

Editor American Machinist:

Fig. 1 (page 5) represents an ordinary planer head. *A* is an arm fastened to the head in any convenient manner. It is shown fastened by means of the bolts which hold the swivel head of planer. *B* is a board fastened to the crosshead in such a position that the arm shall be in front of it. *C* is a job to be planed to the shape shown. Take a piece of tin and cut a template of the shape required; mark the outline of it on the board *B*, also on the end of the job *C*. Adjust the pointer of the arm *A* to the top of the outline on the board *B*, and also the tool *D* to the same position which you have marked on the end of the job *C*. Put on the down feed, and by moving the cross feed by hand keep the pointer of the arm *A* directly over the outline marked on the board; the shape *C* will be worked out. The finest down-feed should be used.

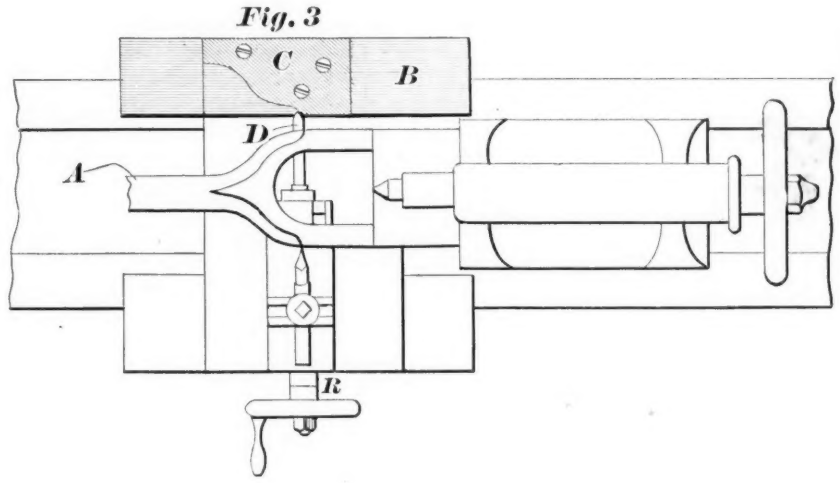
The arm *A* should be made like Fig. 2. *A* is a longitudinal slot, with a movable stud *B*, which can be fastened in any position by means of a nut *C*. This stud has a hole bored in it to receive a steel pointer *D*, which can

be adjusted to just touch the board *B*, and held in position by a small set-screw.

This is also applicable to working out large fillets or curves on lathes. An instance where it comes in handy is on the fork end of connecting-rods. Fig. 3 is a plan of how to work this on a lathe. *A* is a connecting-rod to be turned to the shape shown. This is a very tedious job, and is not done extra smooth by the very best workman. Take a board *B*, fasten it to the lathe bed firmly, allowing room for the carriage to travel under without wrenching it; make a template of the curve you want out of a ½-inch board, screw the same on top of the board *B*, as shown at *C*. Fasten an arm *D* to the end of the cross-head, and by keeping the arm *D* firmly against the template *C*, the curve will be accurately worked out.

Instead of keeping the arm *D* pressed up to the template *C* by hand, a cord might be wound around a small pulley fastened to the cross-feed screw *R*, and a weight attached thereto would keep it pressed up. No greater weight is required than will just move the cross-feed. The curve could be worked the same as on the planer, by merely marking the curve on the board *B*, and keeping the pointer directly over it. Of course the feed is supposed to move the carriage lengthwise. W. C.

Fig. 3

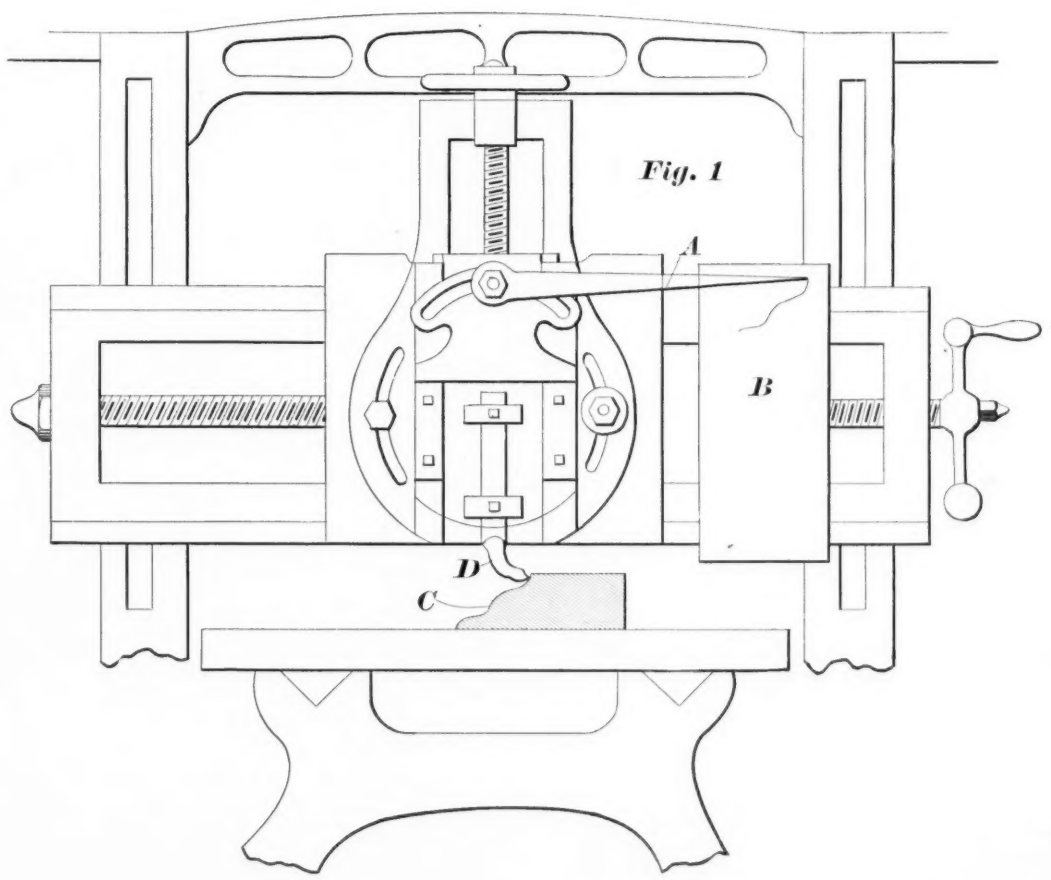


Impossible Machines.

In his opening address at the meeting of the Society of Mechanical Engineers, President Sweet remarked upon the immense inventive labor that had been devoted to the hopeless task of producing a type-setting machine. It is probable that the peculiar operation that would be necessary to set type by machinery will never be accomplished by machinery, yet machinery has been constructed to do work that seems almost as difficult as type-setting. We, in this generation, have come to look upon complex operations done by machinery as nothing wonderful, yet the time was when even the idea of sewing with a machine was deemed a dream of inventive visionaries. Men not very old can remember when the proposal to apply power looms to the production of intricately-formed fabrics was regarded as a hopeless attempt to overcome the impossible. Yet these were easy mechanical feats compared to others that have been successfully accomplished, some of which attract but little attention, and in the ordinary observer excite no astonishment. During a recent visit to a Western manufactory of agricultural implements, and a ramble through a region where such machines were working, we were profoundly impressed with the ingenuity displayed in the designing of many implements of rough exterior that are made to perform operations as accurate as the work of a Jacquard loom, under vastly more difficult conditions. Several forms of self-binding reaping machines are amazing triumphs of mechanical genius. The mechanism that ties the knot on the binding twine is in itself an astonishing device in the unfailing accuracy with which it performs a complex act. Yet the knotting device is only a small part of a combination that has automatically to perform functions that seem beyond the scope of machinery. While jumping along over the roughest kind of ground, meeting with all varieties of crops, the reaping machine does its work, changing automatically to meet the ever varying conditions it may be subjected to. If the crop is thick and heavy, the human-like binder quickens its movements, and ties the band round the sheaves fast; where the crop is thin, it acts leisurely, waiting till a sheaf is full before binding it. Let the horses go fast or slow, this work is done evenly, and the operations are so well regulated that the sheaves are turned off in good order on the roughest ground. The work is done as accurately as the operations of a Hoe rotary printing press, although the machine is subjected to the rough usage of thumping over a furrowed field. After watching the work of such a machine under such conditions, it is hard to convince a beholder that any operation is too complex for a machine to perform.

Gen. Burke has issued a circular advising all exhibitors at the New Orleans World's Exposition to ship their exhibits at once in order to guard against delays in transportation, and complete their installation in time for the opening on December 16. Machinery for the Exposition should be in place ready for steam by December 1. Boilers of

Fig. 1



4,000 horse-power are now in position, the foundations for the engines are completed, and the engines are now being placed. One-half of the shafting is in position.

The Building Committee has ordered a new building for wagon exhibits in the Agricultural Department, and give notice that no further buildings will be erected.

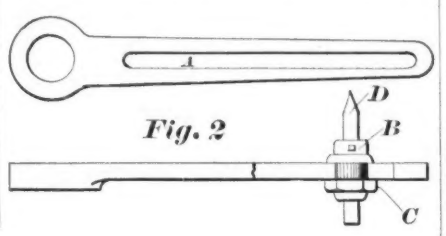
The Exposition management takes the exhibits from the cars and places them on their allotted space free of charge. The freight on exhibits for the departments assigned to woman's work, education, colored exhibits, and for the art gallery need not be prepaid. All the preparations are well in hand, and it is now evident the Exposition could have been opened Dec. 1, so far as the buildings and motive power are concerned. Thus far the Exposition promises to be of unusual interest, and will doubtless benefit the country in many ways.

What Ails Steam Boilers.

The summary of work done by the inspectors of the Hartford Steam Boiler Inspection and Insurance Company during the month of August last, as given in the *Locomotive*, is as follows:

Visits of inspection made	2,607
Total number of boilers examined	5,296
Total number internally "	2,037
Boilers tested by hydrostatic pressure.	434

Fig. 2



Boilers condemned	51	
Whole number of defects reported	3,925	
Whole number of dangerous defects reported	634	

The detailed statement of defects is as follows:

Nature of Defects.	Whole number.	Dangerous.
Cases of deposit of sediment	414	44
Cases of incrustation and scale.	629	58
Cases of internal grooving	16	5
Cases of internal corrosion	139	32
Cases of external corrosion	221	41
Broken and loose braces and stays	81	16
Settings defective	205	10
Furnaces out of shape	107	12
Fractured plates	92	28
Burned plates	176	53
Blistered plates	234	12
Cases of defective riveting	473	87
Defective heads	25	9
Serious leakage around tube ends	428	101
Serious leakage at seams	223	57
Defective water gauges	133	18
Defective blow-offs	39	10
Cases of deficiency of water	20	9
Safety valves overloaded	21	8
Safety valves defective in construction	29	5
Pressure gauges defective	214	19
Boilers without pressure gauges.	6	0
Total	3,925	634

The following notes are appended to the report:

"The evil results likely to arise from the improper location of the feed, or rather, perhaps, we should say the delivery of the feed water into a boiler at the wrong place, are more serious in their character and greater in extent than is generally known. It is no unusual thing, in fact we might almost say that, as a rule, if plain cylinder boilers are fed with cold water through the bottom of the shell, and no provision is made to allow of its thorough incorporation with the water already in the boiler, and assuming the temperature due to the steam pressure, before coming in contact with the bottom plates of the boiler over the fire, these plates will crack through the girth seams, and the owner is fortunate if the boilers do not explode. The force of contraction under such circumstances is irresistable. It is very bad practice to put up cylinder boilers and introduce the feed through the mud drum. It should enter the boiler and be delivered just below the water line. By this means it mixes with and attains a high temperature before it comes in contact with the shell plates, and much trouble is avoided.

"A mistake which is frequently made in setting boilers consists in loading them down on top with a great mass of brick-work, which often does more harm than good. Of course some good non-conducting covering is necessary if we wish to attain a high degree of economy, but for boilers some of the lighter coverings are much to be preferred to brick. This is especially true in the case of long cylinder boilers, of small, or comparatively small diameter. It is no unusual thing to find boilers of this type with several tons of brick and mortar piled on top, which load the boiler has to carry, in addition to its own weight, on two supports, perhaps at the extreme ends. In such cases the girth seams generally show distress near the center of the shell where the greatest strain comes. What is needed is some good light coverings, made in sections, so that it can be easily removed without destroying it, for purposes of inspection, and as easily replaced again."

Those who reason that no improvements have been made in the steam engine during the past quarter of a century, do not reason correctly. While it is true that no sweeping improvements have been made during that time, the minor improvements that have permitted higher speed and higher steam pressure have been numerous and important. The cost of steam power has been, comparatively, most materially reduced during the past twenty-five years, and what is of at least equal importance, improvements in regulation have been made that greatly increase the money value of the power furnished by the steam engine. During that time the locomotive and marine engine, as well as the stationary engine, have been markedly increased in efficiency. There are yet many unsettled problems in steam engineering, the settling of which will have an important bearing on the utility of the steam engine as a motor, but upon these we may look for light to be surely, if slowly, shed. Gigantic strides need not be expected, but the short steps that in time surely cover the distance.

Sound Casting.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

BY THOS. D. WEST.

The term *sound* is of far more importance than any other which can be applied to designate a good casting.

A sound casting can seldom be judged by its outward appearance. The smooth skin is often nothing but a shell covering defects, and not until a casting is broken is its soundness known.

Soundness is often of more value in determining the strength of a casting than the quality of iron of which it is made. A casting made of the best of strong iron can easily have its strength annulled through inner defects. Almost all machinery castings are more or less liable to contain holes from sand, or shrinkage, or blow holes. Often castings are so constructed that even were the moulder to turn them out free of sand or blow holes, the shrinkage hole would show up, were the casting to be broken, despite all the feeding he could do; the reason for this is best shown through an explanation of Fig. 29. Here we have, as is often the case, a heavy and light part connected. Now, were it always practicable to have the heaviest part the uppermost, as seen at Fig. 30, so as to be accessible for feeding, then the moulder could justly be blamed were the casting not sound.

No doubt every engineer will at a glance perceive the difficulty attending obtaining the perfect soundness of such a section as Fig. 29. Here we have the heaviest portion surmounted by a light body, which will become set much the soonest. The light part having frozen, any feeding head that may be over it cannot be of any further benefit in supplying the lower heavy portion to feed its solidifying crust—which, by the way, in many cases may not have begun to set until after the upper light part has solidified. This lower body, having nothing now left to draw from, will draw metal from its uppermost liquid portion, which, in such a section as shown, would leave cavities which would weaken the casting at *A*.

In practice, when such parts as at *A* are required to stand much strain, it is best generally, when practicable, to have an enlargement made, as seen at *B*, Fig. 31. This gives a body which, by means of a feeding-rod and by occasionally pouring hot iron in the feeding-head, will remain in a fluid state as long as the heavy portion. This accomplished, it can be readily seen that a cavity as at *A*, Fig. 29, cannot be formed.

Now it is by no means practicable to attain soundness in all castings by this means, for there are many moulds in which the intended form of the casting would be made almost unrecognizable were the heavy sections thus reached and fed by risers. Attending this is often the impracticability of placing more than three or four feeders upon a mould, for often the bars of the cope, chaplets, binders, and weights will not permit more. Then, again, were it practicable to have a cope filled with feeding-heads, there are many castings which, in order to be sound, would require that more men be taken off from the work of "running off the heat" than foundries at casting time can generally spare.

It is very evident from the shapes of existing patterns and castings, that but little thought has been given to this element involved in obtaining an entirely sound casting.

The best place to study this error is at the "scrap pile." There one can find the shrink hole in many forms. Often fillets which were intended as factors for strength will be found to be exactly the reverse. The greater part of machinery castings made are more or less filleted, and some designers have the idea that the larger the fillet the greater the strength given. In cases where the fillet is fed by other metal than that contained in its central body this may be true. Often fillets are not accessible to be fed by other than the metal contained within the body of casting, and therefore, as illustrated by Fig. 32, a large fillet in such cases may be a source of unsoundness.

A well-proportioned casting should not always be considered only from the standpoint of the strains which its respective parts have to stand. While it is often true that some part may be very light in comparison with others, it is more often better that the light part be made heavy in excess of what its strength requires in order that strains may be avoided, as well as "draw holes," caused through unequal thickness of parts.

To give some data as to what extent ordinary cast iron will shrink, I have lately been experimenting with round balls of different diameters. The sizes of these balls were respectively about 4″, $5\frac{3}{8}$″, $6\frac{3}{4}$″, and $10\frac{3}{8}$″. Two of each size were cast at three different heats, thus making altogether twenty-four balls, and of these twelve were cast without feeders, while twelve had them. The feeding-heads for 4″ balls were $2\frac{1}{2}$″ diameter; for $5\frac{3}{8}$″ balls, $3\frac{1}{2}$″ diameter; for $6\frac{3}{4}$″ balls, 4″ diameter; for $10\frac{3}{8}$″ ball, 5″ diameter.

For the first three sizes the height of head from the flask joint up to the top of gate was 9″, and for the $10\frac{3}{8}$″ balls the head was 12″. The gates which admitted the metal into the moulds were cut broad and very thin, in order that they should freeze a few moments after the mould became full, thereby insuring that metal did not enter through the pouring gates to supply any shrinkage. In pouring these balls, the iron was medium hot, and the gates were filled up to the heights given. The balls having the feeding-heads were "churned" until they solidified.

In cleaning the castings, the feeding-heads were chipped off so as to preserve the spherical form of the balls as much as possible.

This statement with reference to the manner of moulding and casting the balls is simply given to show the conditions under which the tests were made.

The following is a table giving the weights of the balls and the difference between the fed and the unfed balls:

FIRST HEAT.

MIXTURE OF IRON.

200 lbs. ordinary No. 2 pig.
400 " scrap.

Diameter of Balls.	Fed.	Unfed.	Shrinkage Found.	Percentage of Shrinkage.
4″	8 lbs. 12 oz.	8 lbs. 10 oz.	2 oz.	1.428
$5\frac{3}{8}$″	20 " 11 "	20 " 8 "	3 "	0.906
$6\frac{3}{4}$″	39 " $10\frac{1}{2}$ "	39 " 4 "	$6\frac{1}{2}$ "	1.024
$10\frac{3}{8}$″	150 "	147 " 15 "	33 "	1.375

SECOND HEAT.

MIXTURE OF IRON.

100 lbs. No. 1, Bessemer. A strong coke iron.
100 " " Hubbard. " " "
100 " " Pine Grove. " charcoal iron
300 " Machinery scrap iron.

Diameter of Balls.	Fed.	Unfed.	Shrinkage Found.	Percentage of Shrinkage.
$10\frac{3}{8}$″	149 lbs. 12 oz.	148 lbs. 7 oz.	21 oz.	0.876
$6\frac{3}{4}$″	39 " $11\frac{1}{2}$ "	39 " 6 "	$5\frac{1}{2}$ "	0.865
$5\frac{3}{8}$″	20 " 13 "	20 " 9 "	4 "	1.201
4″	8 " $13\frac{1}{2}$ "	8 " 12 "	$1\frac{1}{2}$ "	1.060

This second heat was poured with middling fluid iron.

THIRD HEAT.

MIXTURE OF IRON.

400 lbs. No. 1, Hubbard. A strong coke iron.
200 " Machinery scrap iron.

Diameter of Balls.	Fed.	Unfed.	Shrinkage Found.	Percentage of Shrinkage.
$10\frac{3}{8}$″	149 lbs. 8 oz.	148 lbs. 6 oz.	18 oz.	0.752
$6\frac{3}{4}$″	39 " $12\frac{1}{2}$ "	39 " $7\frac{1}{2}$ "	5 "	0.758
$5\frac{3}{8}$″	20 " 14 "	20 " $9\frac{3}{4}$ "	$4\frac{1}{4}$ "	1.272
4″	8 " $14\frac{3}{4}$ "	8 " $12\frac{1}{2}$ "	$2\frac{1}{4}$ "	1.576

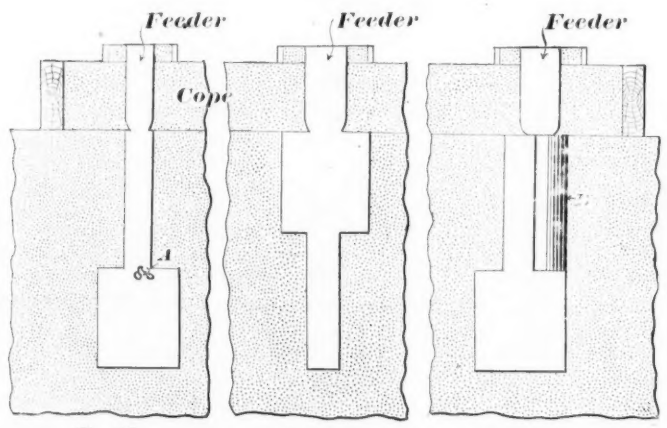


Fig. 29. Fig. 30. Fig. 31.

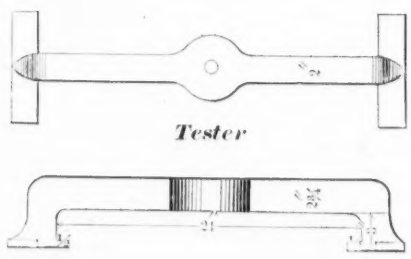


Fig. 32.

In this third heat, with the exception of the $10\frac{3}{8}$″ balls, they were all poured with a more fluid metal than was used in the two upper heats. This I would assign as the reason for the $6\frac{3}{4}$″, $5\frac{3}{8}$″, and 4″ fed balls being heavier than any of the others, as shown.

In classing one heat against another, the mixtures of the iron must be taken into consideration. Balls from each of the respective heats were split open in order to learn, if possible, the cause of the dissimilarity of weight most noticeable in the smaller sizes. The cuts at Fig. 32 illustrate the fractured appearance of the most notable of the split balls. The three smallest diameter unfed balls showed a very open grain at their centers, gradually increasing in density towards the shell. The unfed $10\frac{3}{8}$″ balls were not only very porous at their centers, but contained large holes as well. The flat place seen at *K* showed about how the top part of the unfed balls looked; this was, of course, formed while the crust remained fluid enough to supply shrinkage. After the crust became set, the balance of shrinkage was drawn from the innermost fluid portion of the balls, as proved by the porousness and holes to be seen. The fed balls were the most dense in the middle, the most porous part being about midway between the shell and center, as seen in the cut. The density of some of the fed balls at the center was remarkable, and was a clear explanation of the cause of their variation in weight. The center density was, no doubt, caused only by the pressure exerted by the feeding rod, and the occasional supplying of the feeding heads with hot iron. When feeding a casting, the feeding rod at the latter end, is more or less enlarged, caused by molten metal sticking to it. This may be knocked off or a new rod used, but whichever way it is used there will exist variations in the manipulations of feeding sufficient to cause the dissimilarity in weights seen. It seems reasonable to assert that a thick feeding rod should exert more of a pressure and disturbance than a thinner rod, and that the smaller the ball the more effect could be produced.

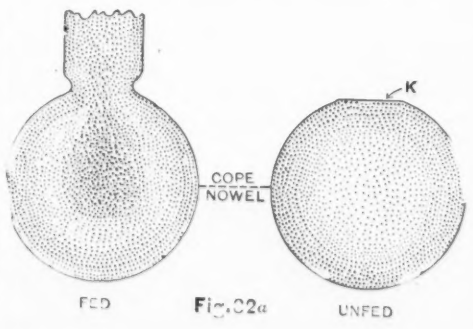


Fig. 32a

In moulding these balls I was very careful in all the manipulations performed. The ramming, venting, drawing of the pattern, and gating, were as near alike as study and care could make them. In feeding, attention was given to the procuring of solid castings. The $10\frac{3}{8}$″ ball would occupy from fifty to sixty minutes to be fed solid, and although these largest balls show about the lowest percentage in shrinkage, they no doubt give the nearest approximation that it would be practical to assign to shrinkage in the general run of castings, which, if called 1 lb. to the 1 cwt. of casting, would not be far out of the way.

While it is essential that a casting should be fed solid to be strong, the quality of the iron used is also a factor for consideration.

Some time ago I made the assertion that metal poured at a dull heat would produce the strongest iron. Having made this assertion, there could be no one more anxious than myself to have seen this kept a maintained fact. Mr. Gardiner, foreman of Pratt & Whitney's foundry, at Hartford, Conn., has informed me that, through experiments which he had made with test bars, poured dull and poured hot, he found the hot-poured bars the strongest. Thinking that I might be in error, from the fact that the tests I had made were but few and crudely performed (as can be seen from the description then given), I desired to give the question a thorough test. Having no testing machine, I devised the simple affair shown in Fig. 28, (page 7) for the purpose of dealing with the subject. In using this machine, bars 1″ square × 24″ long were tested. In all tests the hot-poured bars stood the greatest load.

Before closing I would respectfully call attention to the machine shown in Fig. 28.

This machine was first originated for the purpose of aiding me to determine the strength of the 1″ square bars above mentioned. As some such machine would be found very useful to many, I studied to make it as presentable as possible. The weight of the whole machine is only about 80 lbs., and any one who may choose to give it a trial would, I think, be pleased with its workings, especially in view of the amount it would cost to make one (which should not exceed $6). The machine is best adapted for testing foundry mixtures of iron, and new brands of pig iron. As seen, it will record the three essential points which foundry men ought to know about their iron.

The first is the *contraction* of the iron.

The second its *deflection*.

The third its *strength*.

In obtaining the contraction, the pattern *A*, from which the test bars are to be made,

should be just the length of the distance between the stand-points *B B*. Then, when the bars are cast, all that is necessary, after one is set in place, is to keep it tight to one end, and the space at the other will give the contraction.

For obtaining the deflection, a piece at *F* has a slot through which a thumb set screw binds it against the stand *H*. Before commencing to screw down upon the bar *A*, the piece *F* is set down upon the ratchet wheel *K*, and, being secured by means of the thumb-screw above mentioned, it will, of course, remain stationary. Then, when the bar *A* breaks, its deflection can be told by the space between *F* and the top of the ratchet wheel. The two arms which *F* is seen to have are for the purpose of holding a small 2″ iron rule, divided into 50 or 100 parts, and there are slots in the arms for the purpose of holding the rule.

To obtain the strength, the load is applied by means of the screw *E*, which is $1\frac{1}{4}$″, having nine threads to the inch. In the bottom of the screw there is a steel pin, having a bearing surface of about $\frac{1}{4}$″. The ratchet wheel *K* is, of course, secured to the screw *E*, and a part of the screw projects up above it, so as to leave a pin for the ratchet lever *D* to work upon. The lever *D* is provided with a ratchet pawl, so that the operator can stand in one place while working the screw. Behind the pawl is a spring, so as to force it into the teeth of the ratchet. At *S* is a sliding band, which, when pulled back, releases the hold of the spring upon the pawl, thereby allowing the ratchet wheel or screw to be turned back without removing the lever *B*.

At the end of the lever is a common 25-cent spring balance scale. Across its face, at *R*, is fitted a thin piece of brass or copper plate. A wire is inserted in a small hole which is drilled through the little pin of the balance, which indicates the pounds, to project out from this pin upon each side alike. Then, when pulling the balance, this wire squarely pushes up the registering plate *R*, so that, when the piece to be tested breaks, the plate will register the load.

The length of this lever, from the center of the screw to the point from which the balance pulls, is 18″. The reason for having the balance lying in the semi-circular frame *P* is simply to insure that the pulling is always done in one direction. The scale used with this is the 24 lbs. scale, and a load of 1,200 lbs. exerted upon a bar to be broken will but show about 12 lbs. upon the scale.

In using this machine, were it desired to graduate the scale so as to know in actual pounds what load was being applied, all that is necessary is to set the machine upon some rolling platform scale, which will weigh about 2,000 lbs. After the machine is bolted or clamped to the lower frame of the scales, and the weight of the machine noted, then turn down the screw, and, as the beam of the platform scale rises, mark off upon the face of the spring balance at every hundred a straight mark. Then, after going as high as is desired, the hundreds can be subdivided if preferred. Now, I know that many will object to the use of the screw as a feature of this machine. The machine is certainly one that could not be used as a standard, but it will answer to let a shop know the relative strength of its iron. If the screw is an easy fit, kept clean and well lubricated, the machine should, for such a cheap wrinkle, give good approximate results. At least the deflection and shrinkage are two things which could be counted upon as positive.

When making the test bars, they should be run by means of skimming gates, and in moulding them care must be exercised in order to have the bars come all alike. The bars I used were made in a flask, which had a flat iron bar mortised into each end of the nowel, just as far apart as the pattern is long. By this means the moulds could not be lengthened through any rapping of the pattern.

To know the strength of iron, and the amount which it will shrink, is certainly a point of value in aiding to make strong, sound castings; and, while it is often impossible to know whether a casting is sound until it is broken, we may, through a knowledge of the mode adopted in making it, often be guided in placing confidence as to the strength and soundness of the casting produced.

Machine Worship.

The ingenuity of mankind has devised wonderful means of saddling labor upon machinery, and thereby escaping the burden of the curse that requires humanity to sweat and labor, that the short span of life may be sustained. Ever since the most primitive members of the human family began to use tools, the practice of turning over labor to machinery has kept rapidly increasing. When we examine the numerous processes that machinery has been applied to by nations of the Western world, we are often inclined to congratulate ourselves upon our vast enterprise, and look with pity upon the nations of the East for their ignorance of processes that we practice; yet these Eastern nations were not devoid of enterprise in their time. There are few processes that our super-inventive inventors have not schemed to aid by labor-saving appliances, but we have never seen the record of a patent machine for worshipping God, yet a machine for performing this service was in regular use for centuries in Japan. A recent traveler, who is not reputed to be a relative of Baron

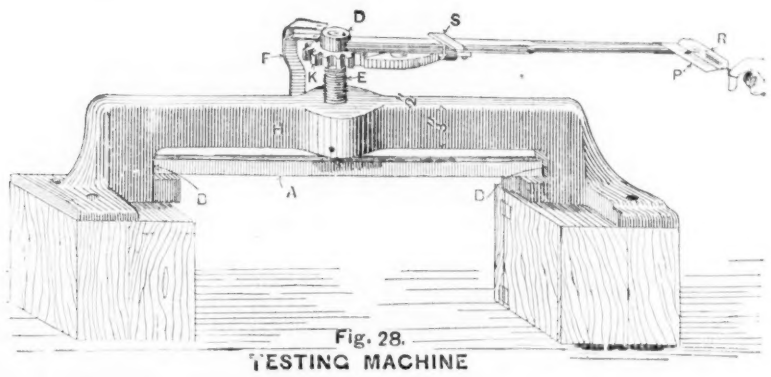


Fig. 28.
TESTING MACHINE

Munchausen, thus describes a Japanese institution:

"Among the many attractions, all within the temple grounds, stands a very handsome five-storied pagoda, painted deep red, and with picturesque projecting roofs. That naturally drew me thither. Very near this tall, quaint building stands a small, neglected temple, with nothing externally attractive to invite the inspection of the foreigner; and as the door is generally locked, no one, so far as I could learn, had ever had the curiosity to enter, and the windows are so closely barred that little can be discerned by peering through them. That little, however, proved to me that this small temple had been built solely to contain one large object so strongly suggestive of the Thibetan prayer wheel that I felt convinced I had found the object of my search. After considerable delay, a very courteous young priest procured the key, opened the great door, and revealed a most beautiful specimen of the Scripture wheel, about ten feet in diameter and twelve in height, of the richest scarlet and gold and black lacquer. The actual cylinder is encompassed with tall, slender pillars, supporting a beautiful wide canopy of lacquer, while the base rests on a stone pedestal of carved lotus leaves—the invariable symbol round the throne of Buddha—the Jewel on the Lotus. This cylinder is, I think, hexagonal, and the handsome panels form six doors for the different compartments of this ecclesiastical book-case, wherein rolled scrolls are arranged in upright order. These treasures are kept securely locked, which, however, nowise lessens the merit acquired by the devout, who (by the aid of spikes projecting from the base, as from a capstan) cause the heavy machine to revolve, sunwise, on its own axis."

The Pittsburgh Locomotive Works are building three locomotives for exhibition at the approaching international exhibition at New Orleans. This will include their three standards eight-wheel, mogul and consolidation.

Prospects for Machinists at Panama.

As we often receive inquiries from machinists and others regarding the prospects for employment on the Panama Canal works, we will give some particulars of the experience of George Mowbray, who returned from Panama on the steamer Colon a week ago. Mr. Mowbray was a machinist, and he worked for the Panama Railroad. To a reporter of the New York *Sun*, he said:

"I was earning $200 a month, but I couldn't stand the climate and had to leave. The mortality there is simply frightful. Forty thousand men are employed on the canal, and hundreds of them are dying every month. The majority of the patients who are sent to the hospitals die there. If the victim leaves money or influential friends, he is put into a pine box and buried, otherwise his body is dumped into a pit and quicklime is thrown over him.

"I have brought several letters to their friends in this country from men who are now dead. One is from H. L. Dunbar, who was a clerk for the Panama Railroad. He died the day before we left Aspinwall. The letter was written by him to his brother, who works at 58 and 60 Worth Street, this city.

"The wages for skilled workmen are $5 50 per day, and for laborers from $3 to $4 per day. The latter are recruited among the natives and runaway sailors, who will leave $18 a month and take their chances of sickness and death for $3 or $4 per day."

Diamond Turning Tools.

Our interesting contemporary, the *Mechanical World*, of London, says: "It is sometimes desirable to reduce the dimensions of a hardened steel article that has received a lathe finish without first drawing the temper, as this necessitates a re-hardening and re-tempering. The usual method of lathe reducing of hardened steel articles by corundum wheel grinding is necessarily confined to straights or tapers, no offsets, collets, or shoulders being amenable to this style of work. A model maker and bright mechanic has succeeded in utilizing the black diamond or bort as a turning tool for hardened steel. He places a crystal in the end of a piece of iron or brass for flat turning, and one on the side of the end or on a corner of the end for side or shoulder turning. He has succeeded in doing some good work with these crude-looking tools. The chips taken from the hardened steel are literally chips, not turnings, and are very minute. But viewed under the microscope they are seen to be cut from the hardened steel, and not merely disengaged crystals. One of the specimens of work with these bort tools is a well-finished V-thread, about 32 to the inch. Two differing crystals of the diamond were employed to cut and true the thread. An adaptation of bort tools to the planer is evidently possible, and there seems to be no reason why its use might not be extended with economical results in the treatment of hardened steel and of chilled iron."

This appears to be another instance where American ingenuity has reached ahead of European mechanical practice. More than twenty years ago a tool maker in Boston was in the habit of truing his lathe spindles after they were hardened by means of a diamond tool, and the practice is followed in many machine operations in different parts of America. Pratt & Whitney's people have used diamonds for several operations in minute cutting. Experience with diamond cutting tools does not, however, indicate that they will ever receive wide application in mechanical work.

Stuck on de Center.

"Say, Sam, what was the matter down at the mill yesterday?"

"Well, you know, boss, de ingin she been gettin' stuck on de center here lately, mi'ty nigh ever' day, an' de boss he got mad an' 'lowed he'd maker go. So he sot me to pullin' down on de belt, an' he war pushin' up on de wheel, and de ingineer he put a scantlin' under de pitman an' sot on tother eend of it, an' de fo'man he war given' her steam. Well, yo' see, boss, she go off mi'ty quick sometimes when she takes a notion, so yistiddy she give a jump as quick as a mule kin kick, an' away she went! An yo' see, when she come over so quick de pitman hit de short eend of de scantlin' an' sent de ingineer froo de roof like er skyrocket, an' de boss he went over de wheel an' out froo de back winder an' lit in de straw pile, an' de belt pulled me down in de wheel pit, an' I staid dar till de fo'man got her shut off agin."

"A narrow escape, indeed."

"Yes, sir-ee, it war, an' deys a mi'ty heap of 'lectricity in a wheel pit when she's runnin' away; it made my har stan' on eend like 'nitin' needles, dat it did!"

A report recently made by the chief officer of United States Ordnance gives interesting details of the operations performed in the various Government shops and arsenals in the last year. An examination of the report convinces us that our Government maintains the old-time efficiency of its means of manufacturing small arms, but little progress has been made towards recovering the lost ground in the production of heavy ordnance. Although the mission of this country is to obtain the substantial victories of peaceful industry, the safety and dignity of the Nation require that the means of self-defence should be efficiently maintained. A select committee of members of Congress have been enquiring into the condition of our natural defences, and it is rumored that they have found them very satisfactory. The recommendation will be made that Congress provide the means for constructing the requisite plant for making the best forms of steel ordnance. Our steel makers will not undertake the production of steel necessary for ordnance without the inducement of being fairly remunerated for the outlay, and this inducement has not yet been offered. While our steel industries are suffering from abnormal depression and the National Treasury is burdened with superabundant revenue, it would be a good time to invest in the material needed for the protection of the country, for the expense would not be felt, and idle hands would receive employment.

We have received from Mr. Clement E. Stretton, C.E, Leicester, England, two copies of a pamphlet describing Joy's valve gear. The pamphlet consists of an address delivered by Mr. Stretton on Joy's valve gear at a meeting of the Amalgamated Society of Railway Servants. It is mostly descriptive, and tells in plain form how the gear is made and its method of action. Mr. Stretton is an earnest believer in the Joy valve gear, and thinks for England it has become a necessity for the locomotives needed to run heavy, fast trains.

It is said that nowithstanding the rapid increase in cotton-seed-oil mills in the South, scarcely more than ten per cent. of the cotton seed is as yet utilized. The products of a ton of seed are valued at about $20. There is yet room for a good deal of enterprise in this direction, and the saving of large sums of money. A very fine quality of oil is made by refining, in fact it is said to so nearly resemble olive oil as to be largely sold for the latter.

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NEW YORK, DECEMBER 6, 1884.

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"Overproduction" Humbugs.

The idea of general surplus production, or "overproduction," is based upon the supposition that the requirements of a people do not increase in any greater ratio than the population itself. The idea is a mistaken one. As machinery and improved methods of production cheapen and multiply the products of industry, each individual wants to consume more, and should be able to gratify his desires to obtain more. It has been claimed by writers upon economic subjects that not only manufactured goods, but also agricultural products, are being brought into existence faster than the people can consume them in this country, and that an increased export trade is the only means of disposing of them. While it is very desirable to stimulate exports it must be apparent that if the ability of the whole population to consume does not keep pace with the increase of production per head, something must be wrong. If there is a flaw in our economic system it would be well for philosophical writers to point it out, if they can discover it, rather than to lecture us upon our exuberance of industrial effort.

When these essayists get tired of pointing out "overproduction" of railroads, iron, woolen goods, cotton goods, glass, machinery, and everything else to the end of the chapter, they should either show where there is underproduction to employ idle hands, or close by proclaiming an overproduction of labor—an excess of population. In a country like ours such a theory will not stand. Labor, in many places, is now unemployed, and has not accumulated enough to remain so without privation. The remedy is not, as some would have us believe, in a still greater stoppage of the wheels of industry, and the enforced idleness of a larger number of people. The trouble is widespread, and when Congress meets next week intelligent action should be taken to restore, if possible, some of the lost business activity. On the first of October the U. S. Treasury contained, according to official report, over $526,000,000 in coin, bullion and paper currency, or more than $9.50 for every one of the 55,000,000 people of this country. Recent reports all show that the money in the Treasury is steadily increasing. Meanwhile there is a stringency among business men in money matters. Indebtedness increases. This vast fund in the Treasury should not remain there where it cannot be used. A great part of it should go into circulation, and the people are looking to Congress for some action that will put it into circulation.

Libelling American Workmen.

We find an article in the *Scientific American*, copied from the *N. Y. Journal of Commerce*, discussing immigration and export trade. On reading it we were surprised to find the following expression in regard to the immigration of foreign artisans:

"Here the trades-unions find their toes trodden on, and they cry out against the proposition. Wages, in their judgment, are already too low, and they will not have the number of skilled workmen increased by any foreign importation. And not only the higher class of mechanics, but the miners, the hod-carriers, the 'longshoremen, and the ditchers are ready with pistol, club, and slungshot to resist every attempt to flood the country with rivals to share in the labor they would monopolize for themselves."

This is a base and false accusation against American mechanics and workingmen. Instead of offering violence to foreign artisans who come to this country to find a home, they are ever ready to accord them all the rights and privileges as workmen enjoyed by native citizens. If the writer of the above quoted paragraph is an American, he is a willful falsifier. Neither the "higher class of mechanics," nor unskilled workmen lie in wait for foreign immigrants with "pistol, club, and slungshot."

What injures the reputation of this country abroad more than all facts that can be mentioned are the printed tales of such "continental liars" as the writer of the above-quoted paragraph. These tales are reproduced in foreign journals, and easily gain credence. The belief is easily disseminated in Europe that immigrants are generally met at Castle Garden by a mob armed with clubs, slungshots, pistols and paving-stones. More circumspection on the part of daily (and some weekly), newspapers would be very desirable, especially as regard for truth is often lacking.

The superintendent of the Lower Pacific Mills, Lawrence, Mass., sends us a copy of their "winter arrangements" time table of working hours. It is headed, "Working time, ten hours a day or sixty hours a week." This is the way the time is divided:

Commence work.....6 30 A.M.
Leave off work, except Sat'd'ys. 5 45 P.M.
Leave off work Saturdays.....4.15 P.M.
Hours for dinner through the week.....12 M. to 1 P.M.

Some time ago we copied an item from the *Boston Bulletin* mentioning that the superintendent of this mill was brought before the police court in Lawrence, charged with employing women more than sixty hours a week. He was acquitted, as the short time on Saturday compensated for the longer time on other working days. This fact, however, was not mentioned by the *Bulletin*. We have since learned that the machinery in the Lower Pacific Mills was started a few minutes before bell time, and that some women who were *employed by the piece* commenced to work as soon as the machinery was in motion, thereby working more than sixty hours a week. The company did not *require* anybody to begin work until bell time. They started the machinery sooner so as to get it in good working order by bell time.

Brotherhood of Locomotive Engineers.

This organization is operated through divisions that take the place of lodges, and are established in every part of the United States, Canada and Mexico, where enough locomotive engineers are located to keep up a meeting place. The divisions, which now number two hundred and fifty-eight, are subordinate to and under control of the Grand International Division, whose headquarters is at Cleveland, Ohio, and of which P. M. Arthur is grand chief, and T. S. Ingraham, grand assistant engineer. Under the management of these officers, a monthly journal is published, devoted to the interests of the order, and formed principally from articles contributed by the members. Once a year the brotherhood holds a convention, which is the legislative body of the organization, and consists of delegates sent from the various divisions. The convention is seldom held twice at the same place, but is usually convened at points where a gathering of brotherhood engineers is likely to exert a good influence on other engineers who do not belong to the brotherhood, or who are lukewarm in its support. Thus each meeting is intended to have a proselytising effect.

This year the Annual Convention of the Brotherhood of Locomotive Engineers met at San Francisco, Cal. From the address of Grand Chief Arthur, we learn that the brotherhood has passed through a most prosperous year, although, from the depressed condition of business, generally, they had reason to expect unfavorable fortune. Twenty-four new divisions had been established during the year, raising the membership above sixteen thousand. A notable feature of the new membership was that it consisted mostly of young men. Two divisions were in operation in Mexico, and were prospering, with good promise for the future in that country. They have experienced no trouble during the past year that was not satisfactorily adjusted, except that of the engineers in Winnipeg, and the opinion is expressed that, had the members there been less hasty, a settlement might have been made satisfactory to all concerned. Reduction of wages will follow a general depression of business, and deliberate action is necessary in such a case.

The circulation of the monthly journal was fifteen thousand for each issue during last year, and the officers think it can be made much greater if the members will display proper interest in securing new subscribers.

One of the most valuable features of the brotherhood is the insurance, which provides a sum of $3,000 to the widow or heirs of a deceased member. Membership in the insurance is optional to general members of the brotherhood, but a goodly proportion of the engineers belong to it. During the last year the increase of membership in the insurance was 664. Forty-two policies had been paid last year, amounting to a sum of $126,000. Since the insurance was instituted $1,533,169.61 have been paid to the heirs of deceased members, besides $500,000 more given to the sick and needy. This work alone makes the Brotherhood of Locomotive Engineers worthy of respect, admiration and moral support.

The Hoboken (N.J.) Division, Brotherhood of Locomotive Engineers will give a musical and literary entertainment at Music Hall, Orange, N. J., Wednesday evening, December 27, for the benefit of sick and disabled members, some of whom have been unable to do any work in more than a year. The tickets are $1 each, and they can be obtained of George H. Sticher, Dover, N. J., or any other member of the Committee of Arrangements. We hope tickets enough will be sold to make up a good fund for this worthy purpose.

Fink and his patent lubricant of water, oil and chalk, lime and potash, have been heard from in Boston, according to the *Manufacturers' Gazette*. Any manufacturer who wants to pay $100 to $300 for a "shop right" to use this mixture in any proportions that may be best for the situation will find Fink ready to do business with him. He has a lot of genuine contracts to show, made by parties who have been humbugged by his oily representations, supported by exhibitions of other contracts. He also shows some recommendations, the writers of which have recalled them, and condemn his mixture. Look out for Fink.

Literary Notes.

A TREATISE ON STEAM BOILER INCRUSTATION and Methods for Preventing Corrosion and the Prevention of Scale. By Charles Thomas Davis. Industrial Publishing Company, Washington, D. C. Price, $2.50.

A great many books have been written about water, but the engineer interested in the character of the water suitable for boiler use finds little information for aid and guidance from their pages. This book is an exception to the rule, for it contains in digested form a great deal of information intended specially for those interested in water for steam boilers. The reader who has studied extensively the subject of water purification will not find much original matter in the book, but he will find the best methods for making tests, the most approved systems for softening water, and the conclusions of the standard authorities on the effects of different kinds of water on boilers, in convenient shape. The author has drawn very freely from Wanklyn and from Frankland, the best British authorities on water analysis, and several good articles on water for steam boilers contributed to European technical journals have been utilized in the work. A slight objection we have to the book is the continual use of the imperial gallon of measurement, and to European waters being invariably cited in giving the quantity of hardening impurities. There are plenty of rivers and lakes in America that contain nearly constant quantities of scale-forming ingredients; and their condition would be more interesting and useful to the ordinary readers of the book, than the condition of the Thames, the Rhine, Loch Katrine and other waters which are so often referred to. In the part treating of methods of purifying water for boilers there seems to be too much tendency to give certain appliances advertisement; and a patent flue cleaner is dragged into the front part of the book without any apparent reason why it should be there. Be-

yond these blemishes the book is interesting and will fill a want.

LOCOMOTIVE ENGINE RUNNING AND MANagement. A treatise on locomotive engines, showing their performance in running different kinds of trains with economy and dispatch; also directions regarding the care, management and repairs of locomotives and all their connections. By Angus Sinclair, member of the Brotherhood of Locomotive Engineers, Member of the American Society of Mechanical Engineers, Associate Member of the American Railway Master Mechanics' Association, etc. John Wiley & Sons, 15 Astor Place, New York. Price, $2.

Some of the matter comprising this book has been revised by the author from articles written by him for the AMERICAN MACHINIST, while other parts are written expressly for the work. Altogether it is a very comprehensive and thoroughly practical book, written from knowledge gained by extended practical experience on the footboard, and in the shop superintending construction and repairs. Throughout it is written in a style that appeals directly to the understanding of those to whom it is more particularly addressed—locomotive engineers, firemen, shopmen and mechanical engineers. It is divided into chapters convenient for reference.

As indicating the scope of the work, so far as its thoroughly practical nature is concerned, we quote, at random, the head lines to a few of these chapters: "Inspection of Locomotives," "Getting Ready for the Road," "Running a Fast Freight Train," "Getting Up the Hill," "Short of Water," "Pump Disorders," "Off the Track," "Accidents to Running Gear," "Setting the Valves." Under these headings, and under those of the rest of the 28 chapters which comprise the book, the reader will find details of actual experience, and conditions likely to be met with, treated minutely and plainly.

The chapter on injectors, and that on the Westinghouse air brakes, and the one on the Eames vacuum brake, will be found particularly valuable, not only as descriptive of those devices, but as detailing the disorders to which they are subject, and explaining remedies both emergent and permanent.

As indicating the author's ideas and aims we cannot do better than give the following from his preface:

"In preparing a book for the use of engineers, firemen, machinists and others interested in locomotive matters, it has been my aim to treat all subjects discussed in such a way that any reader would easily understand every sentence written. No attempt is made to convey instruction in anything beyond elementary problems in mechanical engineering; and all problems brought forward are treated in the simplest manner possible. The practice of applying to books for information concerning their work is rapidly spreading among the engineers and mechanics of this school-spangled country, and this book is published in the hope that its pages may furnish a share of the needed assistance. Those men who Socrates-like, search for knowledge from the recorded experience of others, are the men who in the near future will take leading places in our march of national progress. To such men who are earnestly toiling up the steep grade of Self-help this book is respectfully dedicated."

Those interested in scientific matters will find *Science*, an illustrated weekly journal, published by the Science Company, Cambridge, Mass., to be about the best serial publication they can read. The Company has just published a bound volume of reports of the meetings of the scientific associations recently held in Montreal and Philadelphia as given in *Science* August 29th to October 3d, 1884.

The December number of *The Magazine of Art*, published by Cassell & Company, Broadway, New York, is unusually attractive, although the numbers for the whole year have been uniformly excellent. The pictures of the New Forest are gems of art, painted by Benjamin Vautier, and the engravings are worthy of the original paintings. There are two engravings of Meissonier paintings, and four reproductions of William Hogarth's paintings, all done in good style. The principal part of this magazine is produced in England, but it has a portion giving a monthly record of American art. The magazine is cheap, being only thirty-five cents monthly, or $3.50 a year, yet the engravings and reading matter are of a thoroughly first-class character.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(465) W. J. M., East Saginaw, Mich., asks: In building a small steam yacht, would it be advisable to put the exhaust under water to deaden the noise? *A.*—We should not recommend this plan. There would be danger, under some conditions, of drawing water into the cylinder. If the noise is objectionable there are devices by which it can be deadened.

(466) P. S. S., New Brunswick, N. J., asks: How can I clean small articles of steel that have been tempered in oil, for nickel-plating? They are of such shape that they cannot be come at for polishing. *A.*—You can try removing the oil by dipping in a solution of caustic potash, and rinsing in water; then immerse for a short time in dilute sulphuric acid.

(467) W. U., Collegeville, Pa., asks: In a plain slide valve engine, too large for the work at ⅝ cut-off, will it be best, in the interest of fuel economy to arrange to cut-off at half-stroke, or to run at slower speed? *A.*—The propriety of arranging to cut-off at half-stroke can only be determined by a complete knowledge of the engine. The engine being designed for ⅜ cut-off, on general principles it will be better to reduce the speed,

(468) L. C., Nyack, N. Y., writes: I have an engine, about 7 horse-power, doing very little work. The travel of valve is 1¾"; outside lap, ⅜"; inside lap, 0. I propose to put in a new valve with same travel, and outside lap ⅝",no inside lap. How will it work? *A.*—It will probably do very well under light load. It will not open much port, but perhaps enough under the circumstances. If the construction was such that you could use 3-16" inside lap without partially stopping up exhaust passage, it would be an improvement.

(469) R., Oswego, N. Y., writes: Haswell, on "Steam Acting Expansively," says: "Multiply the ratio thus obtained by the pressure of the steam (including the atmosphere)," etc. Now, why add atmosphere pressure? and does this apply to high-pressure, condensing and compound engines? *A.*—It applies to all calculations of the kind made of steam. It is necessary to start at the beginning of pressure, that is, from vacuum, as a base, because there is no other way of calculating conveniently. The correction is made in subtracting the back pressure. For instance, if the engine is theoretically perfect no subtraction would be made for a condensing engine, but for a non-condensing engine the back pressure will be one atmosphere.

(470) R. B., New York, sends sketch of exhaust pipe for a 3"x4" engine, 200 revolutions, in which there are three sharp turns, and asks: 1 Will they not cause back pressure on the piston? *A.*—The tendency of such turns is to cause back pressure. If the pipe is, say, 1¼" diameter, we think you will not be troubled with back pressure. 2. The boiler is upright, fire-box 19" diameter and 20" high; 17 tubes 2" diameter and 32" long. How can I calculate the horse-power? *A.*—Calculate all the surface, in square feet, that is exposed to the action of the fire and heated gases, and divide by 12. This surface is the sides of the fire-box, the part of the lower tube sheet that is not occupied by the tubes and the interior surface of the tubes. 3. What is the power of the engine with 60 pounds boiler pressure? *A.*—Probably about one horse-power. 4. Water is continually being thrown out of the exhaust pipe, caused by condensation in the pipe. Would it not be a good plan to put a drip in the elbow near the engine? *A.*—Yes.

BUSINESS SPECIALS

Transient Advertisements, 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Curtis pressure regulator and st'm trap. Nov. 22, p.10.

Katzenstein metallic packing, 169 Christopher st., N Y

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Figs per set $1.00. S. M. York, Cleveland, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N Y.

Friction pulleys and couplings; cheapest and best H. N. Bates, 358 Atlantic avenue, Boston, Mass.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.

Power Measured—F. Van Winkle, mechanical engineer, 22 Cortlandt street, New York.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York

Consulting Engineer and Mechanical expert, C. C Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

The Straight-Line Engine Company, Syracuse, N. Y., will send their new catalogue on application.

Mech'l drawing and machine designing, work requiring skill and experience solicited Reasonable rates. Corresp'nce invited Weston & Smith, Syracuse, N.Y.

DRAWINGS—Mechanical, electrical and Patent Office. All styles of artistic designing. Special facilities. Low rates. Wallace Metcalf, 140 Nassau St., N.Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50: Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Locomotive Engine Running. By Angus Sinclair. Price, $2. A handsome, interesting book. Just the thing for a holiday gift. Published by John Wiley & Sons, 15 Astor Place, N. Y.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

Useful Information for Steam Users—A 100-page pamphlet, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Every engineer should have this book. Send 25c. in P. O. stamps to the J. N. Mills Publishing Company, 145 Broadway, N. Y.

MANUFACTURES.

Pratt's Iron Foundry at Campello, Mass., is nearly completed.

H. T. Beggs, Sr, Birmingham, Ala., will build a stove foundry.

Phillips & Co. are building a cotton mill at Yazoo City, Miss., with a capital of $600,000.

Geo. Hey, 331 Broome St., New York., will erect on 165th St., a factory 51x126 feet, to cost $9,000.

A new cotton mill is in course of erection for the Trenton Manufacturing Company, at Trenton, Tenn.

The Hartford Machine Screw Company, at Hartford, Ct., is building a brick addition to its extensive works.

The Northeastern Railroad Company's machine shops at Meridian, Miss, lately burned, are being rebuilt.

The Gibson & Lee Manufacturing Company has been organized at Chattanooga, Tenn., to manufacture stoves.

R. C. Miles and LeRoy McBee, of Greenville, S. C., will establish a foundry and machine shop in that town.

J J Nestor, 152 Broadway, New York, will erect on 128th Street a six story brick factory, 56x90 feet, to cost $30,000.

The Lansing, (Mich.) Iron Works are erecting a 30x60 brick addition to their building, more room being necessary.

Wm. Cutting, New York, will erect on 1st Avenue and 42d Street, a brick factory, 198x42 feet, 4 stories high, to cost $35,000.

Charles Lesinsky, 13 E. 83d St., New York, will build a five-story brick factory, 75x90 feet, on 48th St., to cost $30,000.

Smith & Haldeman, Toledo, Ohio, will move into their new shop soon. It is 110x100 feet. The firm manufacture elevators.

The Crescent Steel Works, at Pittsburgh, Pa, can turn out in an emergency an ingot of steel weighing 13,200 pounds at one heat.

The new Featherbone factory building going up at Three Oaks, Mich., is of immense proportions.—*Grand Rapids Morning Telegram.*

Success for the proposed Co-operative Shoe Company at Metheun, Mass., is assured, upward of $10,000 of the stock having been thus far taken.

Summers & Murphy, of Barnesville, Ga., whose carriage factory was lately burned, are rebuilding as rapidly as possible on an enlarged scale.

The Southern Wheel and Handle Company, of Owensboro, Ky., are now building a factory in Louisville, Ky., to which they will shortly remove.

The "Acme" steam pump, made by the Valley Machine Company, Easthampton, Mass., took the first premium at the Louisville, Ky., Exhibition just closed.

The wooden shipbuilding yards in the vicinity of Philadelphia are not likely to make any contracts this winter for new schooners, as the coastwise trade is already overdone.

The Aroostook *Herald* understands that parties have been in Presque Isle, Me., looking over the town with a view to erecting and putting in operation a large machine shop.

The Nashua (N. H.) File Works, which some months ago were burned out, have purchased a large tract of land and erected new shops on a much more extended scale.

M. M. Buck & Co., St. Louis, Mo., are manufacturing a very compact form of sand drier, which is made entirely of cast iron, and is claimed to have a capacity of 20 tons daily.

The Goodall Manufacturing Company is erecting a new woolen mill at Sandford, Me., which, when finished, will be 150 feet by 100 feet in area, and will be used for combing, weaving and finishing plush.

The Portland & Ogdensburg railroad will build a new car shop at Thompson's Point, Me., near the Basin. The building will be 50x200 feet in size, and will probably be completed by the first of January.

The work on Proctor's paper mill at Constantine, Mich., is progressing rapidly, and the structure will be completed in about nine weeks. Seven or eight grades of paper will be manufactured, including silk-tissue.

C. L. Lee, Athol, Mass., has nearly completed another hoe factory, 140x45 feet, and four stories high. Power will be furnished by a 90 horse-power engine. Mr. Lee will employ nearly 800 hands when his new factory is completed.

Hutchinson Brothers, general machinists, Manchester, N. H, have added to their business the making of castings of all kinds, and have erected a new building near their machine shop, which they will use as a foundry.

The cotton factories at Petersburg, Va., have shut down on account of the scarcity of water caused by the protracted drought. Seven hundred people are thrown out of employment, many of whom are suffering for the necessaries of life.

The Egan Company, Cincinnati, report that the outlook in wood-working machinery is "only fair to middling." First-class machinery is low in price. The new automatic knife grinder made by the company is meeting with excellent success.

W. T. Comstock, 6 Astor Place, New York, has issued a 75-page illustrated catalogue of drawing instruments. It seems to be very complete. Many of the articles are small, and can be sent conveniently by mail. Prices are mentioned in every instance.

The Pioneer Iron Works, of Brooklyn, N. Y., will hereafter build the Zell safety water tube boiler at their works, corner King and William Streets. They will carry all sizes in stock. L. B. Eaton, 22 Cortlandt St., New York, will continue to act as general Eastern agent.

It is stated that the Lehigh Valley railroad has made a contract with the Bethlehem Iron Company for ten thousand tons of steel rails, to be delivered during the winter and spring. The price at the mill, which is on the line of the Lehigh Valley railroad, is to be $27 per ton.

In acceptance of a $2,500 bonus, and the guarantee of a yearly business of $100,000, Bird & Clarage will open a branch foundry at Battle Creek in the spring, to handle the immense foundry business for the Grand Trunk Railroad, the Union School Furniture Company, and the threshing machine manufacturers of that city.

G. H. Morrison, of the Pacific Guano Company, Coosaw, S. C., says the great want in machinery circles in that part of the country is good machinery castings, produced at home. He thinks a good foundry would pay well in that State and section generally, the present practice being to send North when good castings are required

The Reading, Pa., Foundry Company, Limited, is a new corporation largely made up of the same membership as the Mellert Foundry and Machine Company, Limited. The new company, however, is entirely distinct from the latter. Arnold Mellert is chairman, and P. D. Wanner is secretary and treasurer. Ten acres of land have been purchased for the use of the new organization, but the erection of buildings will depend upon the condition of trade during the next six months

The Cummer Engine Company, Cleveland, Ohio, are greatly encouraged by the success of the "Jonathan Mills Flour Dresser," of which they are selling a great many. They are also selling many "Finch" rolls. They have just taken an order to build a refrigerating plant for the brewery of Rothaker Bros. & Thomas, of Philadelphia. It comprises two refrigerating machines, two condensers and other apparatus. Another order was received from Henry Zelters, Morrisania, N. Y., for a large refrigerating plant, with 67 horse-power engine, complete. They have recently received quite a number of orders for Cummer engines, among them one of 95 horse-power for Amos Bros'. flouring mills, Syracuse, N. Y.; two of 67 horse-power each for the Citizens Electric Light Co., Akron, O.; one of 150 horse-power for Upton Manufacturing Company, Port Huron, Mich; one of 170 horse-power for Hedley Company's cotton mill, Holyoke, Mass; one of 287 horse-power for the West Shore Railroad Shops, Frankfort, N. Y.; and one of 170 horse-power for the cotton mills of W. H. Cheney & Company, Mountain Mills, Ala.

The Fall River manufacturers say that a general reduction of pay in the Rhode Island mills is probable, and that if it comes they will have to cut wages also.—*Manufacturers' Gazette.*

Machinists' Supplies and Iron.

NEW YORK, November 20, 1884.

The situation of the supply trade cannot be said to have undergone any perceptible improvement during the week. Political excitement is subsiding and men are directing their attention to business; but the uncertainty as to what will be the policy pursued by the new Government in regard to industrial matters has a depressing influence on trade.

Iron—The market for pig continues in the depressed condition reported from week to week, with, perhaps, a more pronounced tendency toward still lower prices than has previously been experienced. The higher brands maintain prices, but the lower brands are subject to concessions. The introduction of Southern iron into the market influences the lower brands prejudicially. The quantity of Southern pig put into Northern market is not nearly so large as has been rumored, but it has depressed prices, nevertheless. We quote No. 1 X. Foundry, nominally $19.50 to $20, for standard brands, and $18 to $19 for No. 2 X. Grey Forge, $15 50 to $16.50.

Scotch Pig—Sales are mostly confined to arrive and for shipment. Prices are irregular. Shotts, $21.50 to $21.75, to arrive; Coltness, $22, to arrive, and $22.50 from yard; Glengarnock, $20 50 to arrive, $21 50 yard; Eglinton, $19 50; Langloan, $21.

Copper—The market for ingot has ruled dull, and prices weak. Lake has been sold at 12¾c., and even less; other brands are quoted at 11⅝ to 12¼ cents.

Lead—The market for common pig has ruled dull and weak. Sales are rumored to have been made at 3.35 cents, although 3.40 is quoted as the lowest price.

Tin—Business in this line has been fair, and prices steady. For jobbing lots, Banca is quoted at 19¾ to 19⅞c.; Straits and Malacca, 16¾ to 17⅜c.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—A first-class mechanical draftsman. S. R. Krom, 93 Washington St., N. Y.

An experienced mechanical draftsman, 2 years in his last place, wants a situation. Address "Shop and Office," AM. MACHINIST.

Mechanical draftsman, with shop and drawing-room experience, desires engagement. Excellent references. Address BOX 8, AM MACHINIST.

Wanted—A competent man as foreman of boiler shop. Must have best of references. Phœnix Foundry & Machine Co., Syracuse, N. Y.

Wanted—Draftsman experienced in machine tools and capable of designing special machinery. Address, salary expected and experience, "Special," care AM. MACHINIST.

Position wanted by a man 35 years of age, accustomed to push and apply mechanical specialties. Well up in practical mechanics and engineering. Address D, care AM. MACHINIST.

Valuable hoist pat. for sale. Illus. in AM. MACHINIST Nov. 15, 1884. Address Hy. Erric, 1361 Ridge Av, Phila., Pa.

Wanted—One new planer, 36x36x10 feet; one second-hand planer, 30x30x8 feet. State lowest price and full description. George R. Lombard & Co., Foundry, Machine and Boiler Works, Augusta, Ga.

For Sale—A 60 H.-P. Lowe Pat. Boiler; first-class condition. Reason for selling is that we have replaced it with 120 H. P. boiler. For particulars, address Kearney & Foot Co., N. Y. City. Also for sale, a Knowles No. 1 pump, nearly new; reason for selling, have replaced it with a No. 4, same make.

STEPHENS PATENT VISES.

50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by the trade. Send for circular.
MELVIN STEPHENS, Prop'r, Office, 41 Dey St., New York.

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SIMPSON'S
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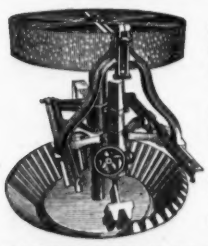

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36 Oliver Street, Boston, Mass.
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800 N. SECOND ST., ST. LOUIS, MO.
MACHINERY FOR SALE.
SECOND-HAND.
One Putnam Screw-Cutting Engine Lathe,
42 Inch Swing, 26 feet bed, all complete, in fine condition.
Catalogues of New Machinery on Application.

BRADLEY'S HEATING FORGES.

ESTABLISHED 1832.
For Hard Coal or Coke. Indispensable in all shops to keep Bradley's Cushioned Hammers and men fully employed and reduces cost of production.
BRADLEY & CO. Syracuse, N.Y

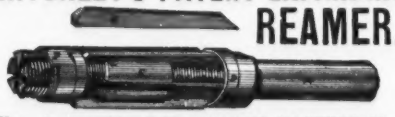
Finished Pulleys
AT FOUR CENTS PER POUND,
to close out stock on hand. Send for printed list of dimensions.
THE JOHN T. NOYE MFG. CO., Buffalo, N. Y.

THE BROWN HAMMER
STRIKES A BLOW WITH
DOUBLE THE VELOCITY That it Raises the Hammer.
A NEW MOVEMENT { SEND FOR DESCRIPTION.
KNOWLTON MFG. CO., King St., Rockford, Ill.

P. BOISSET, 197 GREENE STREET, NEW YORK.
Manufacturer of
Hand Screw Chasers.
PRICE PER DOZ. PAIR.
From No. 6 to 16 Threads, per inch, $4.20
" " 17 to 26 " " " 3.60
" " 27 to 50 " " " 3.00
Warranted of best cast steel.
CHASSERS for Wood, Bone and Ivory TURNERS.

MACHINERY
For Reducing and Pointing Wire.
Especially adapted to pointing wire rods and wire for drawing.
For Machines or information, address the manufacturer,
S. W. GOODYEAR, Waterbury, Ct.

CRITCHLEY'S PATENT EXPANDING REAMER.



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Dynamo Electric Machinery:
A Manual for Students of Electrotechnics.
BY SILVANUS P. THOMPSON, B.A., D.Sc.
388 pages, 8vo, cloth, illustrated by 230 engravings.
Price, $5.00.
E. & F. N. SPON, 35 MURRAY STREET, N. Y.

The Deane Steam Pump Co., HOLYOKE, MASS.
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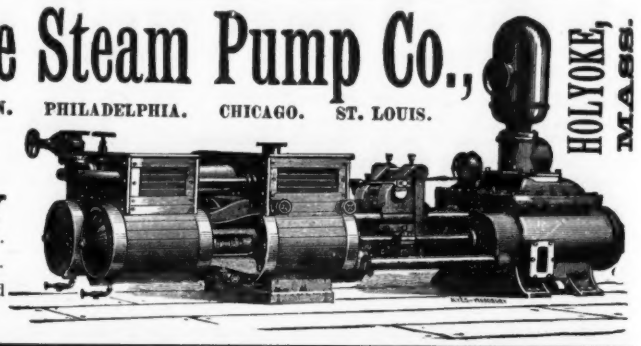

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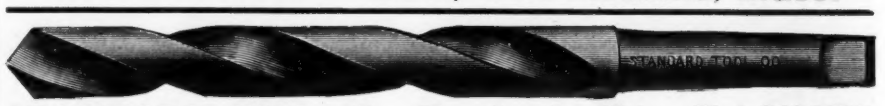

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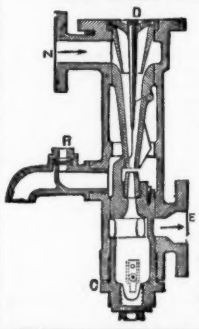

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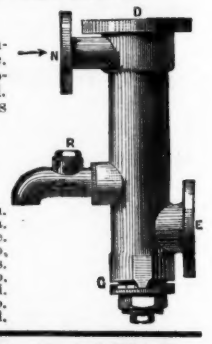

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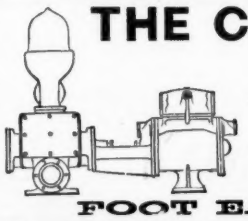

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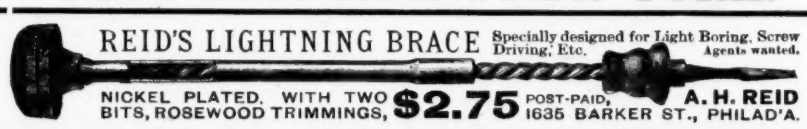

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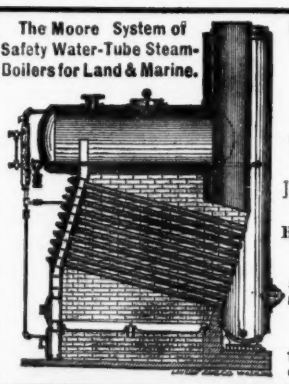

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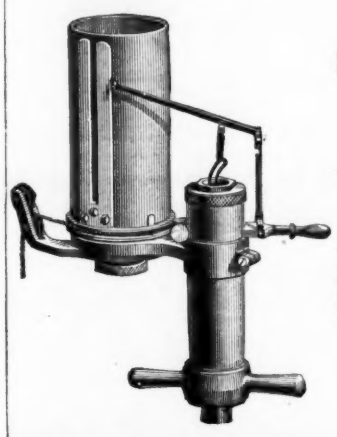

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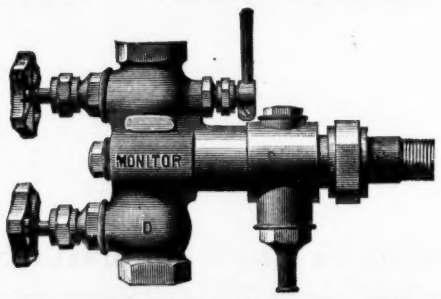

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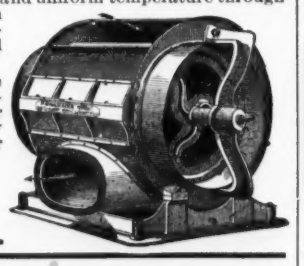

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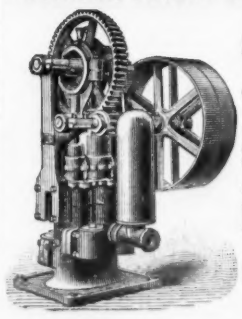

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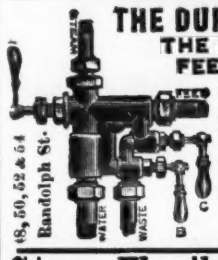

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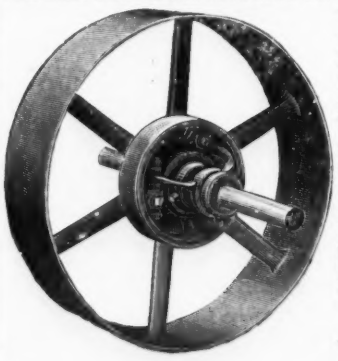

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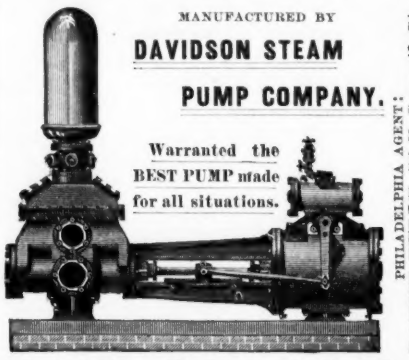

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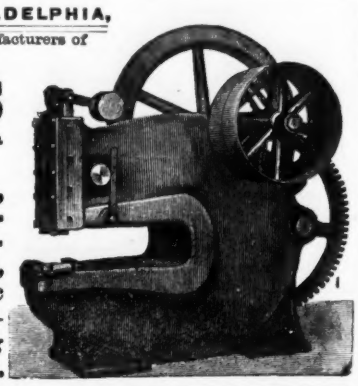

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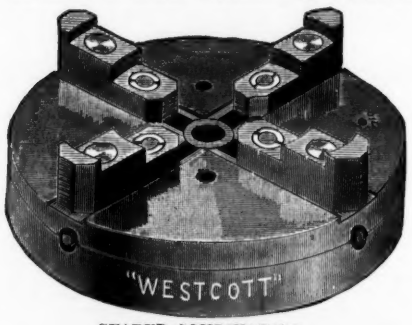

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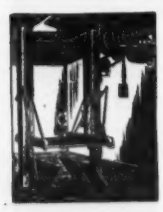

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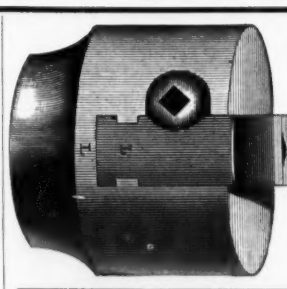

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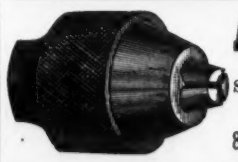

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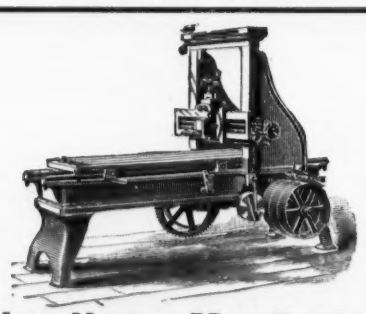

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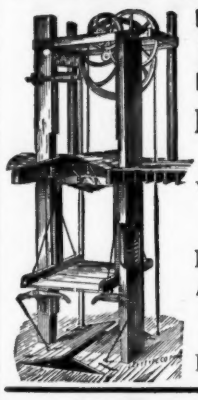

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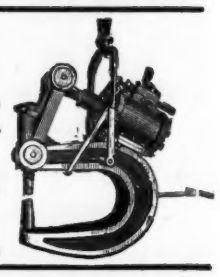

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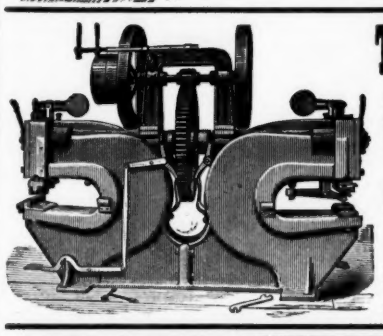

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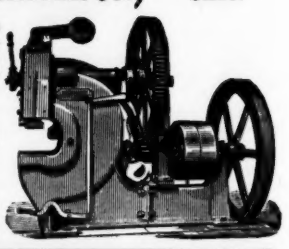

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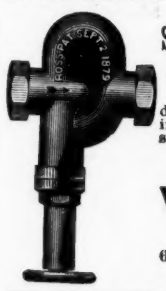

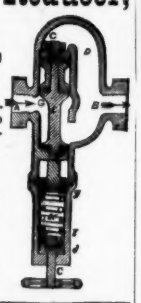

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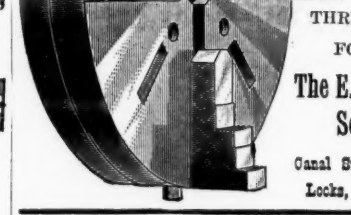

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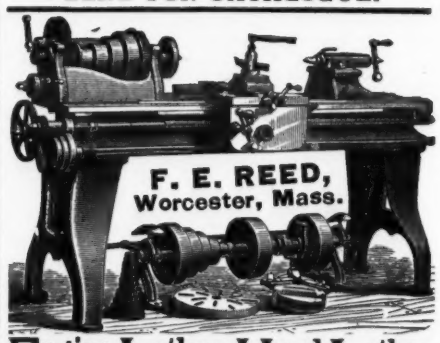

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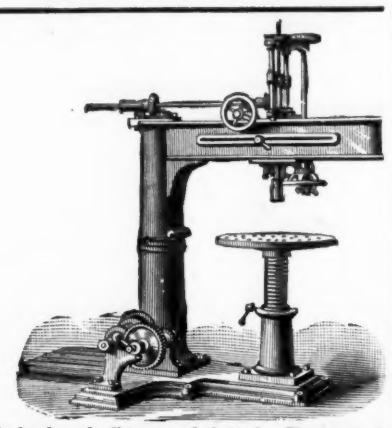

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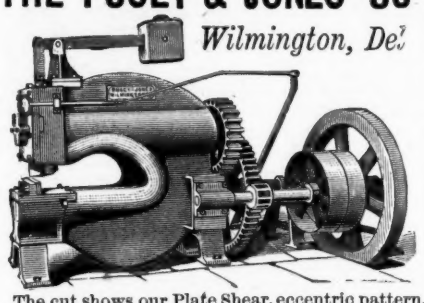

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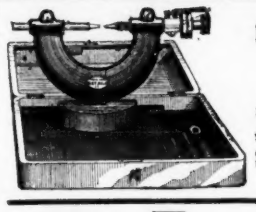

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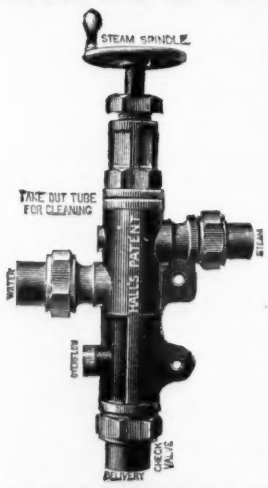

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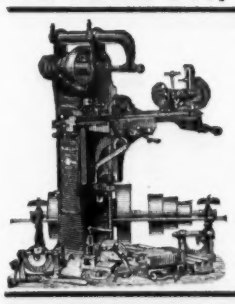

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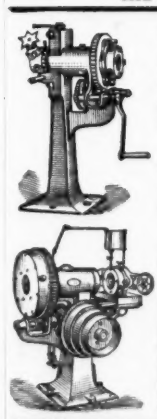

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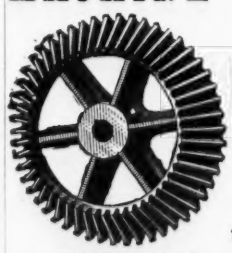

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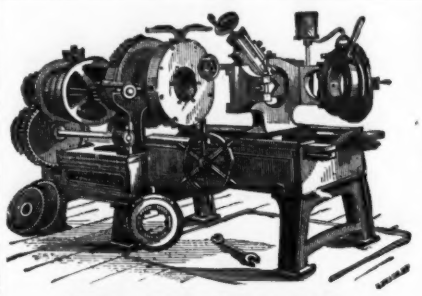

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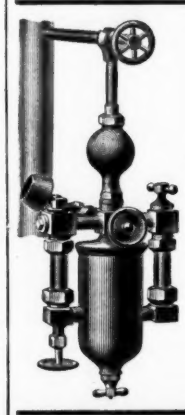

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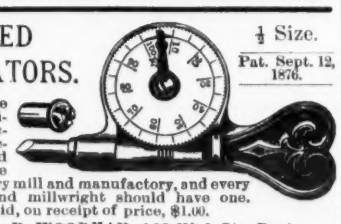

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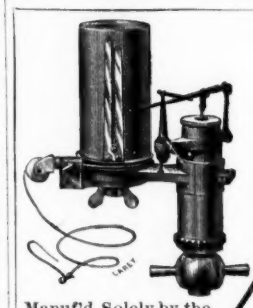

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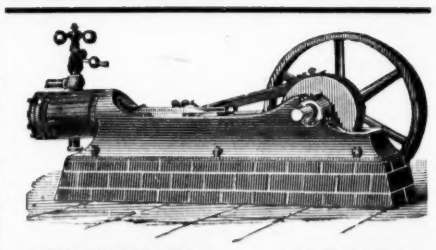

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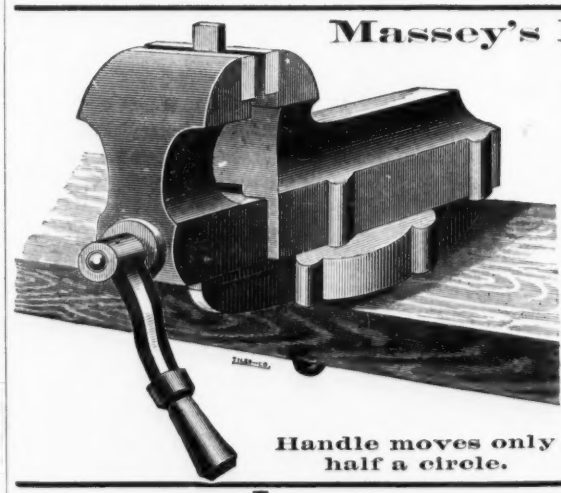

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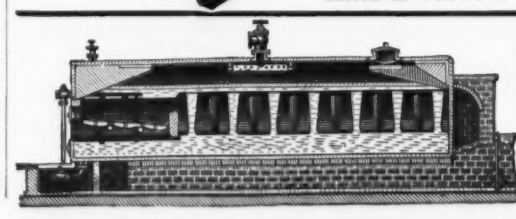

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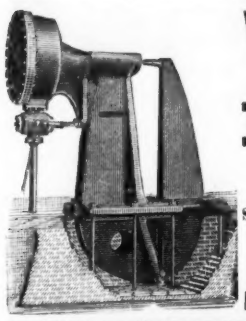

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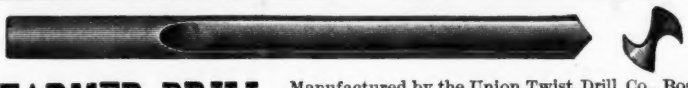

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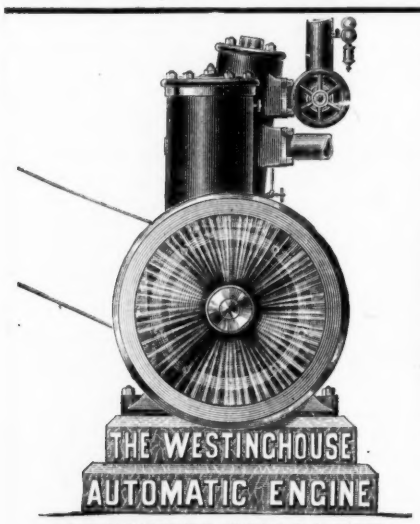

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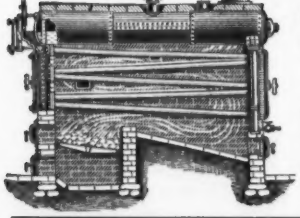

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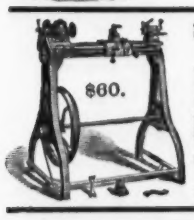

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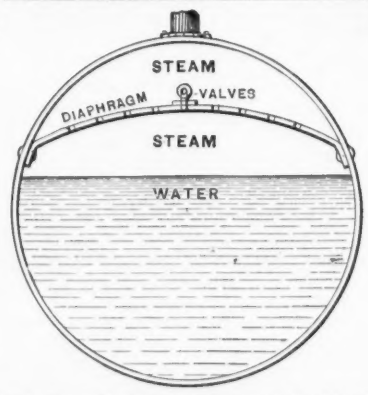

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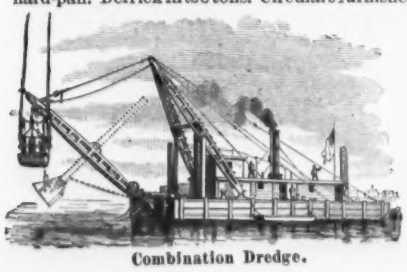

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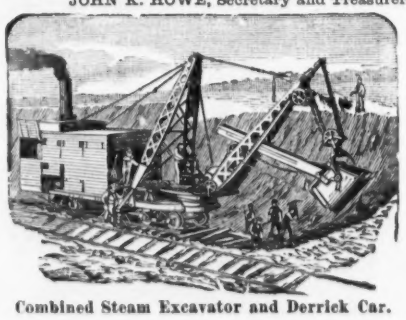

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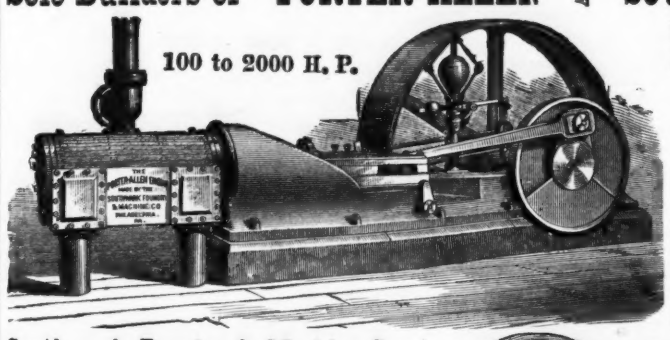

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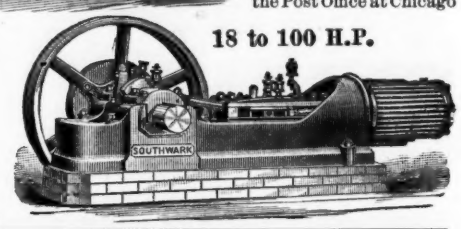

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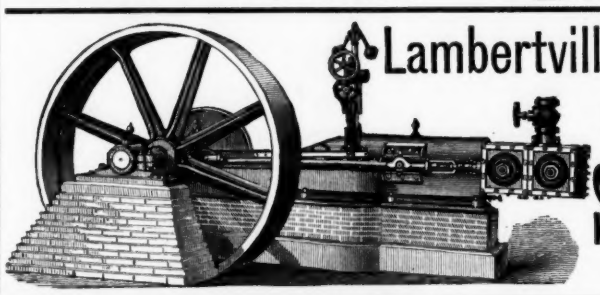

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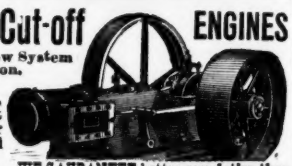

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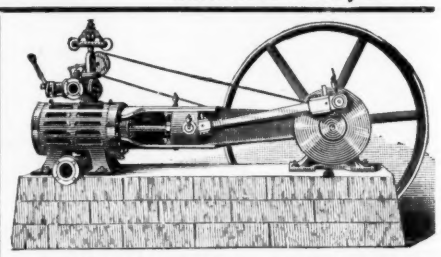

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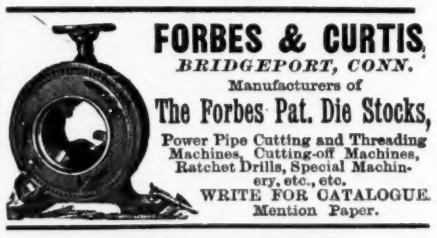

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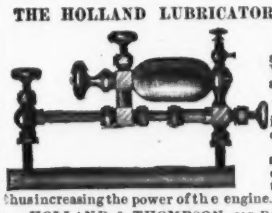

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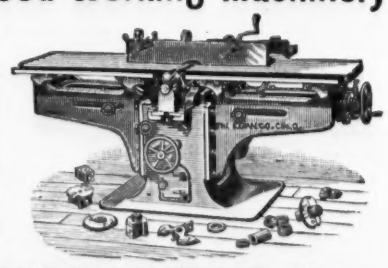

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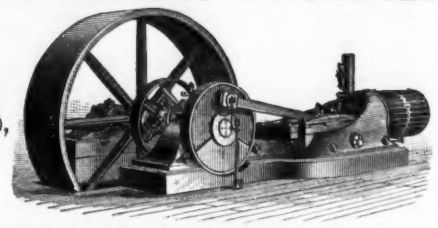

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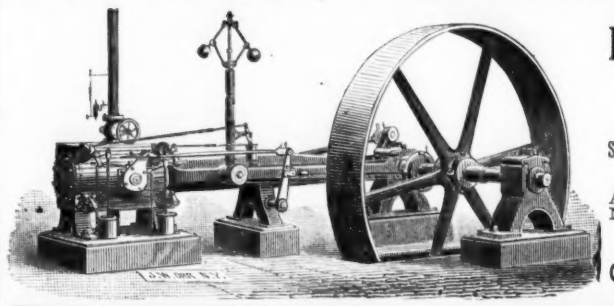

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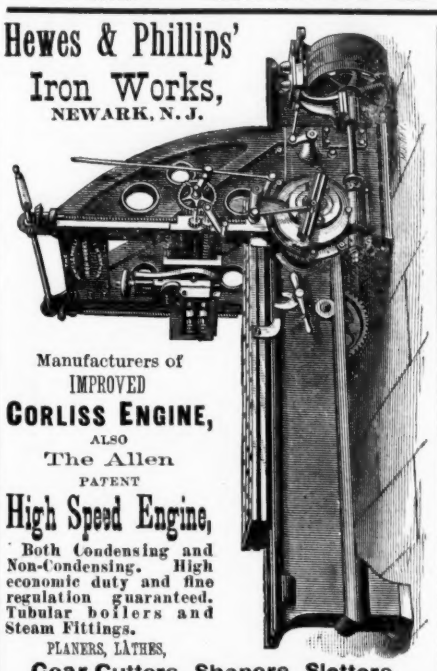

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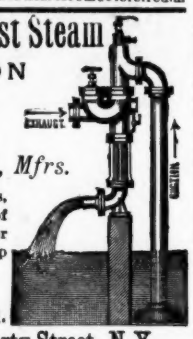

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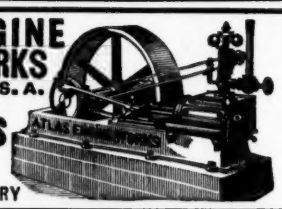

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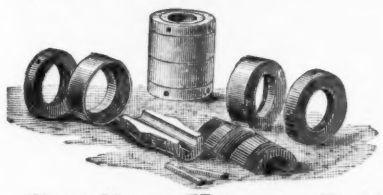

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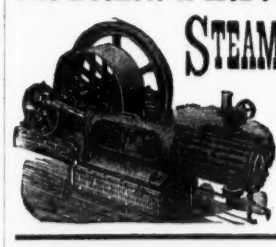

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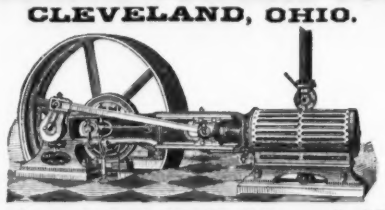

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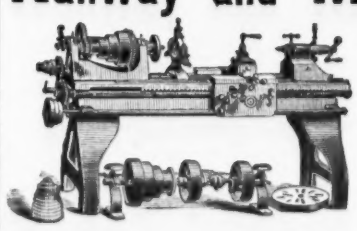

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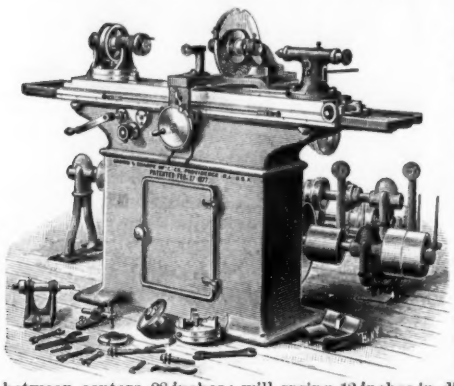

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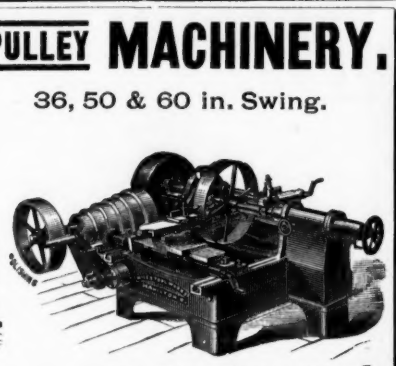

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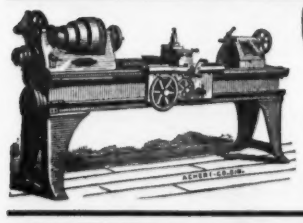

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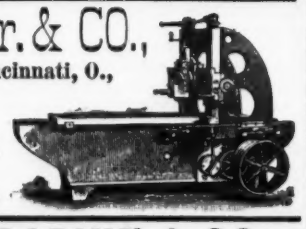

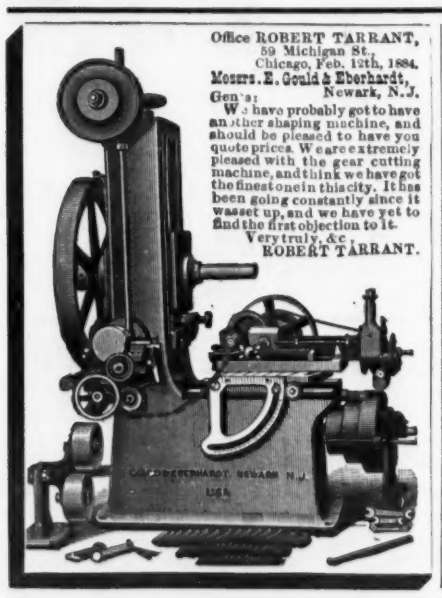

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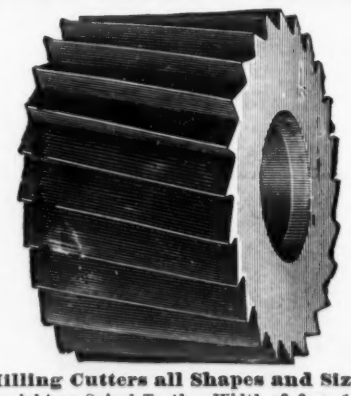

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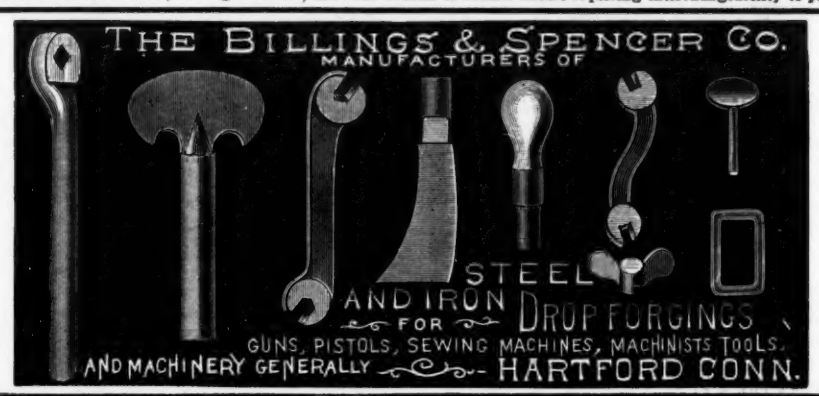

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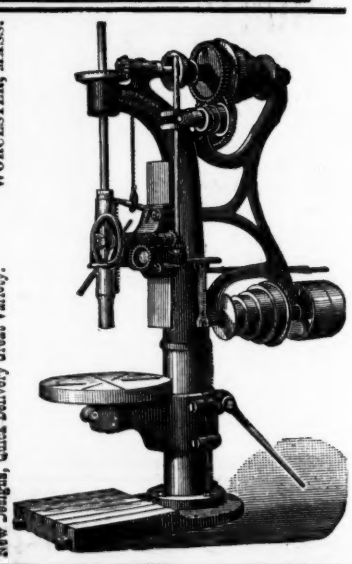

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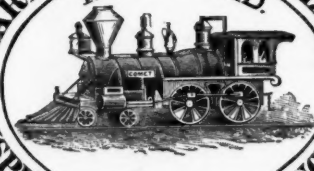

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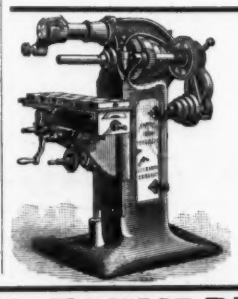

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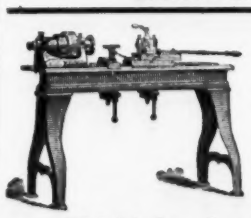

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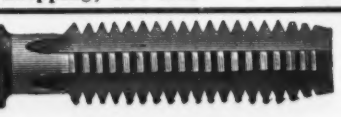

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